

IADIS
INTERNATIONAL
CONFERENCE

25 - 28 February
Barcelona, SPAIN

e-society 2009

PROCEEDINGS

Volume I

Edited by:
Piet Kommers
Pedro Isaías



iadis

international association for development of the information society

IADIS INTERNATIONAL CONFERENCE

e-Society 2009

**PROCEEDINGS OF THE
IADIS INTERNATIONAL CONFERENCE
e-Society 2009**

Volume I

BARCELONA, SPAIN

FEBRUARY 25-28, 2009

Organised by
IADIS

International Association for Development of the Information Society

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Edited by Piet Kommers and Pedro Isaías

Associate Editors: Luís Rodrigues, and Patrícia Barbosa

ISBN: 978-972-8924-78-2

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FOREWORD

These proceedings contain the papers and posters of the IADIS International Conference e-Society 2009, which was organised by the International Association for Development of the Information Society, in Barcelona, Spain, February 25 – 28, 2009.

The IADIS e-Society 2009 conference aims to address the main issues of concern within the Information Society. This conference covers both the technical as well as the non-technical aspects of the Information Society. Broad areas of interest are eSociety and Digital Divide, eBusiness / eCommerce, eLearning, New Media and E-Society, Digital Services in ESociety, eGovernment /eGovernance, eHealth, Information Systems, and Information Management.

The following eighty-three topics have been object of paper and poster submissions:

- **eSociety and Digital Divide** - Connectivity may imply social coherence and integration. The opposite may result as well, when systematic measures are taken to exclude certain individuals or certain groups. Papers are welcomed on the next keywords: Social Integration, Social Bookmarking, Social Software, E-Democracy, Social Integration;
- **eBusiness / eCommerce area:** Business Ontologies and Models, Digital Goods and Services, eBusiness Models, eCommerce Application Fields, eCommerce Economics, eCommerce Services, Electronic Service Delivery, eMarketing, Languages for Describing Goods and Services, Online Auctions and Technologies, Virtual Organisations and Teleworking;
- **eLearning area:** Collaborative Learning, Curriculum Content Design & Development, Delivery Systems and Environments, Educational Systems Design, E-Citizenship and Inclusion, eLearning Organisational Issues, Evaluation and Assessment, Political and Social Aspects, Virtual Learning Environments and Issues, Web-based Learning Communities;
- **New Media and E-Society area:** Digitization, heterogeneity and convergence, Interactivity and virtuality, Citizenship, regulation and heterarchy, Innovation, identity and the global village syndrome, Internet Cultures and new interpretations of “Space”, Polity and the Digitally Suppressed
- **Digital Services in ESociety area:** Service Broadcasting, Political Reporting, Development of Digital Services, Freedom of Expression, E-Journalism, Open Access
- **eGovernment /eGovernance area:** Accessibility, Democracy and the Citizen, Digital Economies, Digital Regions, eAdministration, eGovernment Management, eProcurement, Global Trends, National and International Economies, Social Inclusion
- **eHealth area:** Data Security Issues; eHealth Policy and Practice; eHealthcare Strategies and Provision; Legal Issues; Medical Research Ethics; Patient Privacy and Confidentiality.

- **Information Systems:** Electronic Data Interchange (EDI), Intelligent Agents, Intelligent Systems, IS Security Issues, Mobile Applications, Multimedia Applications, Payment Systems, Protocols and Standards, Software Requirements and IS Architectures, Storage Issues, Strategies and Tendencies, System Architectures, Telework Technologies, Ubiquitous Computing, Virtual Reality, Wireless Communications.
- **Information Management area:** Computer-Mediated Communication, Content Development, Cyber law and Intellectual Property, Data Mining, ePublishing and Digital Libraries, Human Computer Interaction, Information Search and Retrieval, Knowledge Management, Policy Issues, Privacy Issues, Social and Organizational Aspects, Virtual Communities, XML and Other Extensible Languages

The IADIS e-Society 2009 Conference had 276 submissions from more than 43 countries. Each submission has been anonymously reviewed by an average of three independent reviewers, to ensure the final high standard of the accepted submissions. Out of the papers submitted, 56 received blind referee ratings that signified acceptability for publication as full papers (acceptance rate below 21%), while some others were published as short papers, reflection papers, posters and doctoral consortium. The best papers will be selected for publishing as extended versions in the IADIS International Journal on WWW/Internet (ISSN: 1645-7641).

The conference, besides the presentation of full papers, short papers, reflection papers, posters and doctoral consortium, also include a keynote presentation. Special thanks go to Professor Jeremy Millard, Danish Technological Institute, Denmark for his keynote presentation.

In addition, e-Society 2009 features a Tutorial by Professor Paul Nieuwenhuysen, Vrije Universiteit Brussel, Belgium and a special talk by Carlo Maria Arpaia, senior official, Bank of Italy, Liaison with Treasury Department.

As we all know, a conference requires the effort of many individuals. We would like to thank all members of the Program Committee (139 top researchers in their fields) for their hard work in reviewing and selecting the papers that appear in this book. We would also like to thank all the authors who have submitted their papers to this conference.

Last but not least, we hope that everybody has a good time in Barcelona, and we invite all participants for next year's edition of the IADIS International Conference e-Society 2010.

Pedro Isaías, Universidade Aberta (Portuguese Open University), Portugal
Conference Chair

Piet Kommers, University of Twente, The Netherlands
Conference Program Chair

Barcelona, Spain, February 2009

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KEYNOTE LECTURE

CURRENT TRENDS AND FUTURE DRIVERS IN EGOVERNANCE – A VISION FOR 2020

by Dr. Jeremy Millard, Danish Technological Institute, Denmark

Abstract

This presentation traces both the longer and shorter term developments in European governance and technology to provide a context for articulating a detailed vision of eGovernance in 2020. It shows how this vision is not automatic but depends upon important institutional and mindset changes which may not happen, even though there is strong evidence that some already are and that wider conditions (including the current economic turmoil) can be conducive to bringing them about. The paper offers some practical approaches to achieve the vision, but also outlines the dangers even if the vision is realised, particularly new types of digital divide and challenges to the overall mandate and role of government and the public sector.

SPECIAL TALK

NET ECONOMIES AND PUBLIC FINANCE STATISTICS: THE SIOPE EXPERIENCE

**by Carlo Maria Arpaia
senior official**

Bank of Italy - Liaison with Treasury Department, Italy

Abstract

Monitoring of public finance aggregates and ratios has become more and more important within the EU in compliance with Maastricht Treaty parameters; the need for timely data about public spending trends is particularly pressing in Italy, where a high public debt ratio exists alongside non-uniform accounting standards across public entities and the Government's intention to introduce fiscal federalism.

In order to address this issue, the Italian Ministry for the Economy and Finance (MEF) and the Bank of Italy decided to create the General Government Transactions Information System (SIOPE). After 3 years of intensive work with different types of public entities, their banks, software houses and other stakeholders, SIOPE now receives on a daily basis electronic data covering 90 per cent of S-13 public entities cash-flows, enabling MEF and the Italian National Institute of Statistics (Istat) to speed up the processing of public finance data. Even if SIOPE still has ample scope to improve data quality and develop new outputs, it is a clear example of what successful outcomes are possible with inter-institutional cooperation and an intensive use of network technologies.

The aim of this paper is to illustrate the main advantages of SIOPE's working method and the main problems to be addressed, in order to provide other countries (especially emerging economies) with guidelines on creating this kind of information system. Keywords: General government, State and local budget expenditure, technological change.

CONFERENCE TUTORIAL

INFORMATION RETRIEVAL IN A WORLD OF SCATTERED INFORMATION SOURCES

**by Paul Nieuwenhuysen
Vrije Universiteit Brussel, Belgium**

Abstract

Information sources are scattered throughout the Internet and WWW; this hinders finding and using information. Therefore, methods and techniques to cope with this reality have been developed at the level of system creators. Two techniques are mainly used: on the one hand aggregating smaller sources in a bigger searchable database and on the other hand federated searching through several existing database in one simultaneous action. Concrete applications that can be exploited by end-users are presented. For the two approaches we outline limitations, concerns, advantages and disadvantages.

Full Papers

BLOG CONTENT ANALYSIS: REFLECTIONS AT BUKIT CHANDU SINGAPORE HERITAGE SITE

Schubert Foo

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ABSTRACT

The National Archives of Singapore commissioned this study to carry out a content analysis of blogs in relation to the World War 2 Interpretative Centre, Reflections at Bukit Chandu (RBC) that was opened in 2002. Such analysis will provide important supplementary feedback and information to those that are already obtained via official feedback forms, occasion interviews of walk-in visitors, and online feedback from users of virtual exhibitions.

Blog analysis is a relatively new area of research that poses significant challenges due to the unstructured nature of blog contents, lack of established methodology and lack of specialized software tools to aid such a genre of content analysis. This work aims to directly contribute towards the understanding of blog analysis in these areas. A total of 54 English and Chinese blogs, website and wikis that spanned from 2002 to 2007 were analyzed. A combination of software tools including Chinese word segmentation, concordance, qualitative analysis and spreadsheet were used to process the data to yield a set of output that include strengths, weaknesses and recommendations for RBC. Arising from this study, a proposed methodology for blog analysis is proposed. Lessons learnt, challenges and desirable features and functions for a content analysis tool are recommended to carry out and improve blog analysis in future.

KEYWORDS

Reflections at Bukit Chandu, National Archives of Singapore, heritage interpretative centre, blog content analysis, concordance, NVivo, Chinese word segmentation

1. INTRODUCTION

The National Heritage Board (NHB) of Singapore was set up to champion the development of the cultural and heritage sector of Singapore. It provides state-of-the-art archival and conservation services through the National Archives of Singapore and the Heritage Conservation Centre. It operates seven leading museums and heritage interpretative centers that include the Asian Civilisations Museum, Memories of Old Ford Factory (MOFF), National Museum of Singapore, Peranakan Museum, Reflections at Bukit Chandu (RBC), Singapore Art Museum and Singapore Philatelic Museums. MOFF and RBC were developed and maintained by the National Archives of Singapore in 2002 and 2007 respectively.

RBC is a World War 2 (WWII) Interpretative Centre to commemorate the gallantry and sacrifice of men of the 1st and 2nd Battalion Malay Regiment who defended the western sector of Singapore in February 1942. Bukit Chandu is the name of a hill known to locals as “Opium Hill” probably due to the British-owned opium packing plant that was established on the foot of the hill around 1910. RBC was the one of the bungalows built for its senior officers by the colonial government and used to store military food supplies during WWII. It was at this hill that the Malay Regiment fought one of the fiercest battle while defending the island in the last stand before Singapore fell to the Japanese. RBC has a monthly visitorship of around 6,000, that includes school children, local and foreign visitors throughout the world. Visitors are invited to sign a guest book or visit the online site (http://www.s1942.org.sg/s1942/bukit_chandu/homepage.htm) to leave their remarks and impressions of the centre. Occasion interviews of walk in visitors are also carried out by staff to obtain feedback from visitors. Information obtained via these channels form the bulk of the feedback obtained for RBC.

At the same time, the pervasiveness of Web 2.0 and its associated social technologies, have surfaced and yielded an increasing number of RBC related blogs and wikis written by visitors. This study was

commissioned by the National Archives to review the contents of such blogs to augment existing feedback since these are important “active” feedback as they are posted voluntarily by visitors and bloggers who have taken the time and effort to journal, review and contribute towards the contents. This study was undertaken by two Master of Science – Library and Information Science students who analyzed a series of blogs from 2002 to 2007 to highlight the views of the bloggers, identify strengths and weaknesses of the physical site, exhibits, programs, and services. The aim was to provide a set of recommendations for management and future developments of RBC (Men & Ei Kay, 2007).

Content analysis of blogs pose a set of challenges as the blogs were multilingual, and information contained in blogs were highly unstructured, of varying lengths and written in different levels of vocabulary, and can contain other formats beyond text like images, sound and multimedia. There is also apparently no software tools that are currently in existence specifically designed for blog content analysis. As such, a set of research related objectives was also defined for the study, namely, to develop a suitable methodology for analysis, source and utilize suitable tools for blog analysis, identify key issues and provide recommendations for blog analysis in future.

2. BLOG CONTENT ANALYSIS

2.1 Related Work

Blogs, or weblogs, have become extremely popular among the online community as it offers an easy and inexpensive means of self-publication of content for a potential vast audience on the Web as they are more flexible and interactive than previous publication formats, print or digital (Herring et al, 2004). There are virtually little barriers to entry and generally no central authority in managing and moderating blog contents in the weblogsphere.

Spadaccini (2006) conducted a survey of museum blogs and community-based sites to ascertain the level of activity within the museum field. Four search engines (Google, Technorati, Feedster and Ice Rocket) were used to search and locate blog sites and postings. Information was obtained for the blog name, institution (museum), entry dates for the first and last entry, whether comments can be added by visitors, individual or multiple contributed blogs, and software used to power the blogs. Based on 25 blogs identified, museum blogs were found to be used largely to share photos and videos of museums and installations, and explore current events and exhibitions. The blogs were evenly split in terms of being run by individuals and groups. Blog sites were powered by a variety of software packages that include Blogger, Dupal, Live-Journal, TypePad and Word Press. The survey concluded that in term of sheer numbers, museums have been slow to develop blogs and community sites, with blog numbers literally being one-in-a-million against all blogs on the Web. A substantial increase of blogs was forecasted for the future. This was confirmed in a subsequent study in 2007 where a total of 233 museum blogs were found on the museum.org blogs website in October (Spadaccini, 2007).

The increasing number and importance of blogs have fuelled a range of research areas in blogs. These include identification of splog (spam blog) and source of republication of blogs, link analysis, buzz analysis and social network analysis. (Gregory et. al., 2007). Different techniques have been applied to examine blogs to find out the characteristics of bloggers and their feeling or motivation for postings. These include content analysis (e.g. Herring et. al, 2005; 2006), rhetorical analysis (Miller & Shepherd, 2004), and ethnographic interviews (e.g. Nardi, Schiano & Gumbrecht, 2004). Content analysis in our study context refers to analyzing the structure, purpose and themes of blogs, bloggers’ posts and visitors’ comments of blogs. It aims to synthesize and comprehend the whole blog environment by identifying trends, and carrying out analysis to yield relevant information of the institution. A literature search on conference proceedings of the International Conference on Weblogs and Social Media (ICWSM), Association of Computational Linguistics (ACL) and ACM Special Interest Group on Information Retrieval (SIGIR) suggests that little work has been done and reported in the area of content analysis of museum blogs to date.

Prior to this study, there was a previous one commissioned by the National Archives of Singapore to carry out a blog analysis of the Memories of Old Ford Factory(MOFF) in 2007. Qi, Liu and Song (2007) analyzed 24 blogs, wikis and website related to MOFF through the aid of the qualitative analysis tool, NVivo7, and derived a set of findings that was categorized into 4 main categories: Events, Exhibits, Other

Sites, Services. Bloggers' comments and their accumulated responses on the installations such as the Audio-Video Theater, Interaction Displays and Wartime Garden, artifacts and statues such as Lt General Percival (Commander of British Forces in Singapore) and Lt General Tomoyuki (Commander, 25th Japanese Army) provided clear indications of the interests, impressions, feelings and preferences of the visitors. Comments on the guided tours, opening hours and MOFF brochures were also useful feedback obtained via content analysis. This pioneering work also provided insights into the challenges and methodology for carrying out museum blog analysis. The inclusion of multilingual blogs and acquiring bloggers' demographics for further analysis were areas suggested for future research. This work provided a number of useful lessons in blog analysis and formed the basis for this current study.

2.2 Methodology

The methodology used for the analysis of RBC blogs is shown in Figure 1. It is adapted from Qi, Liu and Song's work (2007) and refined based on the experience gleaned from that study. The process of blog analysis is broken into distinct phases with accompanying procedures and key activities for each phase.

1	Pre-Processing
1.1	Familiarization of heritage institution to be analyzed (including website, wikis, official blogs, interviews with curators)
1.2	Extraction of key terms in relation to major themes, physical installation, artefacts, events.
1.3	Develop framework and data dictionary
1.4	Classify elements for analysis (text (multi-lingual), image (photos), video, links)
2	Data Collection
2.1	Browse blog directories and use search engines to identify list of blogs, wikis and websites for analysis.
2.2	View and review sites to finalize list of blogs for analysis. In the process, refine data dictionary and elements for analysis, as applicable. (i.e. Refinement of Step 1.3)
2.3	Download blogs.
2.4	Extract each blog from site (converting into textual format for analysis, if necessary)
2.5	Describe non-textual metadata (if none is present)
3	Data Analysis
3.1	Use data analysis software (e.g. concordancer and qualitative analysis software) to import all blogs. In this work, we used Concordance 3.2 and NVivo7 and CIPP (for Chinese text segmentation) as our data analysis tools.
3.2	For the concordancer, customize stop-list and filter blog contents to yield full concordance list for analysis. With the aid of the data dictionary, manually scan through entire word list to identify topics and associated keywords for analysis. New topics and keywords can be added and refined as necessary.
3.3	For the qualitative analysis tool, create nodes based on the topics (Step 3.2). Use keywords as text search queries to locate relevant contents and assign results to defined nodes. Refine and remove all irrelevant entries that are associated with the nodes at the end of the process.
4	Report Generation and Reporting
4.1	Generate detailed reports and statistics.
4.2	Report key findings.
4.3	Provide recommendations.

Figure 1. Blog content analysis methodology

The methodology comprises 4 distinct phases: pre-processing, data collection, data analysis, and report generation and reporting. The pre-processing stage sets the framework for analysis through familiarization of the entity (institution), extracting key terms, defining the data dictionary, and classifying the elements for analysis.

Data collection involves the identification and downloading of the blogs to be analyzed. Blog contents are stored in textual format for analysis. For non-textual data, depending on whether labels or captions are available and assigned by blog authors, metadata can be assigned through the aid of the data dictionary to

facilitate subsequent analysis. Data analysis involves the use of appropriate software tools to facilitate the processing and analysis of data into meaningful topics (nodes) and content to allow findings to be drawn. Unfortunately, there is no existing “all-in-one” software tool that is suitable for blog analysis. In this work, we had to rely on a number of tools. As both English and Chinese blogs were analyzed, we employed a Chinese text segmentation tool known as Chinese Information Process Platform (CIPP) to identify and segment Chinese word units for subsequent analysis. The identification of words is necessary to support information search and retrieval of keywords associated with blogs. This was required as Chinese text has no word boundaries (Foo & Li, 2004).

A concordance tool, Concordance 3.2, was used to facilitate the identification of all key topics and terms of the blog contents as it provides an alphabetical listing of the word concordance that can be easily scanned and manipulated. Such a facility was found lacking in qualitative analysis tools. Using this information, a qualitative analysis tool, NVivo7, was then used to create various nodes with the associated blog contents. We relied on the data dictionary achieve consistency in the identification of nodes. If necessary, new entries in the data dictionary were added, and the text re-processed. Finally, MS-Excel was used as the reporting tool as it provides a suitable means to collate and display the analysis results. The results from the blog analysis process are (1) the identification of a key set of entities, (2) associated blog contents in relation to these entities identified through terms in the data dictionary, (3) summary of key findings along with an indication of their relative importance (based on frequency of occurrence of same or similar comments).

In this work, four search engines: Google blog search engine (blogsearch.google.com), Technorati (www.technorati.com), Feedster (www.feedster.com) and Ice Rocket (www.icerocket.com) were used to retrieve a comprehensive list of blogs and review and selection. A large number of tour guide pages that were returned were ignored as the contents were brief and largely drawn from the official RBC website. Finally, a total of 47 English blogs (that includes a photoblog), 4 Chinese blogs, the official RBC website and 2 wikis were analyzed for data published from 2002 to 2007. While there should be Malay and Japanese blogs that is related to RBC, we did not analysis them in this work due to the lack of expertise in these languages. An attempt was made to obtain information of the bloggers to enable the findings to be associated with demographics and other information. This was subsequently abandoned as the bloggers’ information was found to be largely incomplete, possibly inaccurate and problems were also encountered in obtaining such information from some sites.

It must be acknowledged that while these blogs are not so many and can be manually analyzed by hand for this study, we were interested to explore the use of tools which we believe will help us manage the analysis more effectively, and facilitate analysis of larger volumes of blog contents when these are scaled up considerably in other situations.

2.3 Findings

Arising from the pre-processing stage, a data framework and data dictionary for RBC blog contents was first derived as shown in Figure 2. Four categories were identified: *exhibition*, *building*, *service* and *others*. Each category was subdivided into a set of topics, with a corresponding definition and scope. From here, keywords were identified from appropriate descriptors found in the definition (shown underlined in Figure 2). These keywords and key phrases, which form a basis for matching with blog contents, are augmented and refined during the course of the analysis. In this study, a total of 34 topics were finally identified for analysis.

Category	Topic (Keyword)	Definition
Exhibition	Sculpture	<u>Bronze Malay soldier sculpture</u> displayed in compound outside RBC building
	Artifact-Gallery	Series of <u>photos</u> , <u>newspaper-clips</u> , <u>artifacts</u> depicting the history of the Malay Regiment and the defense of RBC displayed in the <u>glass showcase</u> at Level 1 of RBC.
	Theatre	Bukit Chandu theatre hosting the <u>multimedia interactive animated footages</u> : “ <u>Battle for Singapore!</u> ”, “ <u>Sounds of War</u> ”
	...	
Building	Bungalow	<u>Main building</u> of RBC hosting the various exhibits.

	Staircase	Long and winding staircase from <u>Pepsy Road</u> leading to RBC
	...	
Service	Opening-times	Opening times of RBC to public
	Tour-guide	Tour guide services at RBC
	...	
Others	Canopy-Walk	Suspended 280m <u>elevated metal bridge</u> than runs from <u>Kent Ridge Park</u> to RBC.
	Origins of name	History and background of Bukit Chandu and naming of RBC
Note on Category: Exhibition – Includes all artifacts, exhibits, sculptures shown within and outside RBC main building. Building – Include main and all connecting buildings in bungalow compound Service – Comprises all services for visitors provided by RBC Others – Include all other information not included in above categories		

Figure 2. Framework for content analysis and data dictionary (partial)

Data from the blogs were classified into three main types for collection and analysis. As shown in Figure 3, this includes text content, multimedia content and weblinks.

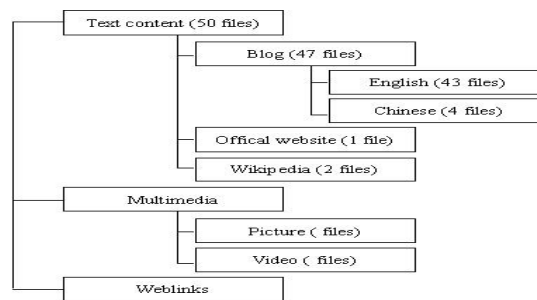


Figure 3. Data classification for collection and analysis

Some blogs contain non-textual content that include pictures, videos and weblinks. In addition to accompanying captions that may exist in the blog, simple metadata based on the category and keywords (of Figure 2) were added based on a manual analysis to facilitate analysis of non textual blog content.

The text of individual blog contents were consolidated together as input for the concordancer. These were processed to yield a full concordance list for analysis. With the aid of the data dictionary previously defined, topics and associated keywords and phrases were identified. New topics and keywords can be added and/or refined as necessary in this process. Following this, relevant and related information pertaining to the topics were organized and classified into nodes in NVivo7 and exported to Excel for reporting. Figure 4 shows a sample of typical output pertaining to the “Theatre” topic (Figure 4a) and report from the analysis (Figure 4b) together with an indication of the number of blogs and content references to this topic.

Theatre	Blog3b	1.1	.. favourite exhibits were Battle For Singapore! ..
		1.2	.. very good multimedia and sound effects ..
		1.3	.. it gave me a better understanding of what the soldiers from the Malay Regiment might be facing when they were bravely fighting against the invaders ..
	Blog4	2.1	..so sad man... especially in the Sounds of War thingy where we put on headphones and hear platoon commander LTA Adnan Bin Said's men and Jap fighting.
		2.2	.. I bet some almost cried... like me.
	C-Blog2	1.1	视听室内定时播放的“战役之声”节目，利用高科技的音效和录音方式，配合录像和话剧般的道具布景，把观众带到60年前的战役现场。 [translated into: .. sounds of war ... multimedia and sound effects .. brings back realism of the battle fought 60 years ago.,]

Figure 4a. Sample of blog contents on Theatre (partial)

Category	Topic	Analysis
Exhibition	Theatre	<p>Number of bloggers: 17 Frequency: 32 references</p> <p>Majority of visitors were impressed with the show and sounds effect. Other related information were gleaned from the show. For example, “Sounds of Battle” is part of the “Noise Singapore” program that won a Gold Award at the 2005 Crowbar Awards. Five bloggers (29%) were particularly moved by the animated sound recording of the battle that left sad and heavy feelings at the end of the show.....</p>

Figure 4b. Sample of analysis output on Theatre (partial)

Arising from the analysis, a detailed set of findings and recommendations were established for RBC. Due to space constraints, we provide in this paper a brief account of the analysis output: Basically, most bloggers were very much impressed with RBC as an important heritage site. They were left with much information and deep impressions of the war that was particularly enforced by the interactive show at the Bukit Chandu theatre. Other popular exhibits at RBC included the Adnan statue, Sculpture, Reflection Well and Memory Window. Little or no mention about the compound Compass, Pillars and Learning Room were recorded although these were introduced and highlighted at the official website. The architecture of the white-and-black bungalow building was another point of interest for visitors. Some bloggers appear to be unaware of the opening hours, while others found difficulty in getting to the venue as it was located in a secluded area with limited transportation options. The tour guides that were only arranged for large visitor groups of more than 15 people were much appreciated and valued. The RBC staff was commended for their high level of service. The rest of the findings are not elaborated in detail here, but can be found in the 47-page project report (Men & Ei Kay, 2007).

2.4 Discussion

Blogs are highly unstructured and authored by individuals from diverse backgrounds and language ability. This free-for-all environment poses significant challenges for analysis. Unlike structured questionnaires or interviews, there are no pre-defined topics or structures to follow. The contents and language of each blog are generally very distinct. “Auto-coding” functions used for structured analysis to automatically categorize content into corresponding topics do not work effectively in blog analysis.

Problems with polysemy and synonyms abound in blog contents. Individual uses different words to mean the same thing, and describe different things with the same words. Even in the same blog, the blogger may use two or different words or labels to describe the same exhibition. These words are all intermixed in the concordance output which pose a difficulty to ascertain accuracy and correct assignment of topics for the postings. Another observation is the use of non-standard words, jargons and misspellings, all add up to additional efforts for processing. As such, blog analysis remains largely a process requiring manual intervention and interpretation.

Multilingual blogs pose additional challenge in terms of language processing. In this work, we explored with the idea of using machine translation to yield a singular (English) language for analysis. This was subsequently abandoned due to the lack of translation accuracy of available tools. Instead, we employed a word segmentation tool to segment the Chinese text into distinct words that can be processed by the concordance to yield a sorted word list of Chinese words. Word segmentation then becomes a necessary step to process languages that contains no word boundaries such as Chinese, Korean and Japanese, and other languages. We also found that a small number of blogs (five blogs) identified through the search process cannot be directly copied or downloaded from the Internet due to the nature and restrictions of the environment hosting these blogs. These were left out of the analysis. No convenient “export” function is generally found in blog software to facilitate the process of blog analysis.

Moving on to blog analysis tools, it was found that no suitable tool was found that comprises a host of functions required for blog analysis exists. The previous experience of solely using NVivo for analysis (Qi, Song & Liu, 2007) points to the lack of functionality of a concordancer to identify words and word phrases along with frequency counts which are important requirements for blog analysis to identify and capture the most important comments and topics found in the blog contents. On the other hand, the flexible “node merge” function (to allow grouping of related nodes) and basic “statistical function” found in NVivo are

very useful for content analysis but only after keywords were identified and readily made available for analysis.

Based on these observations and the experience garnered through these studies, we present a recommended list of functions and features of a blog analysis tool:

- Support for multiple file formats. Currently, most content analysis software supports TXT, RTF and DOC file formats. Support for HTML and other form of markup language such as RTF can dramatically ease the amount of pre-processing and processing work. RTF can become a suitable language for blogs to be exported with content and metadata.
- Automatic batch file import for processing – via user-defined links and paths (that may be used to store blogs in different languages), thereby reducing the tedious work of importing files individually for processing.
- Customizable stop words list - to facilitate automatic removal of user defined stop words and jargons.
- Substitution list capability – to expand jargons and abbreviations into proper vocabulary words (e.g. RBC == Reflections of Bukit Chandu to achieve consistency)
- Provide full and fast concordance ability, and enhanced browsing capability to process word and word phrases derived from blog contents.
Full concordance creates a list of all word from the entire file collection excluding stop words for review and identification. In contrast, a fast concordance allows users to pick or define word or word phrases from specific files and to subsequently generate the concordance from the entire file collection that contains these defined words or phrases. Flexible browsing can be used to support keywords in context (KWIC) browsing and other forms to browsing to provide the context of the text for topic identification and assignment.
- Provide flexible node merge capability during qualitative analysis. This is to support the process of information re-organization and re-classification by allowing users to have a convenient means to delete non-relevant information, create new nodes conveniently and automatically reassign affected contents to the new nodes.
- Enhanced statistical capability for content analysis. For example, the number of sources and references can be accumulated, summarized upon node creation and displayed. This indicates how many times the defined word or word phrases are present in the various blogs.
- Superior and flexible reporting system are desirable for the output information to be generated accordingly to user requirements through templates or other means of report customization.
- Support for multi-lingual content analysis to support word segmentation and processing functions (e.g. for Japanese, Korean and Chinese text).

3. CONCLUSIONS

A blog content analysis was successfully carried out to analyze a series of RBC-related blogs that include text, image, video and weblink data types. A set of tools, namely, CIPP, Concordance3.2 and NVivo7 were used to assist in the analysis. The findings forms an augmented set of feedback for RBC which helps to reinforce those obtained through more traditional means like guest book comments, formal surveys, random interviews and online feedback. The analysis confirmed RBC as an attractive WWII interpretative centre that documents and commemorates the Malay Regiment's defense of the Singapore island in 1942. RBC was commended by bloggers particularly for its comfortable environment, friendly staff, rich exhibitions, and her immersive interactive shows. Some negative remarks were also surfaced in the analysis and these provided the basis for the recommendations and actions for future, for example, to provide free shuttle bus services, guided tours, and so on.

Beyond these outputs and recommendations, the study has achieved its associated research objectives. A methodology for blog analysis is proposed which is possibly the first to be published. Lessons learnt in blog analysis are identified and discussed. A set of recommendations and pointers for the development of blog content analysis software including a list of features and functions for future tool development is proposed. Nonetheless, even with the advancement of such tools in future, blog analysis is still likely to remain a semi-automated process requiring manual interventions and decisions. This is due to the largely un-moderated and

free-for-all nature of multilingual, multi-format and varying levels of language quality found in blog contents.

ACKNOWLEDGEMENT

The author duly acknowledges the National Archives of Singapore, and Men, Y., Ei Kay K.T., Qi, Y., Song, W. and Liu, C. for their involvement and contributions to the project.

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SOME ARE MORE EQUAL THAN OTHERS: CHILDREN'S INTERNET SAFETY

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ABSTRACT

As the internet becomes increasingly available and progressively more important in the modern world, the question as to how safe an environment the internet is for children needs to be addressed. There is no doubt that the internet can be an unsafe place for children to venture into. However, too often, the debate regarding children's online safety is clouded by sentiment. As a result of this emotion driven viewpoint, rational debate is replaced by non-factual speculation. It is important that research in the area of children's internet safety is objective, so as to allow the various stake-holders the opportunity to separate the actual and perceived risks that exist from children using the internet. Only then can suitable policies be pursued to ensure that the children who are most at risk while on the internet receive an appropriate level of help and guidance from those in authority.

The aim of this paper is to separate the actual and the perceived risks that are present as a result of children using the internet. This paper analyses the results of a survey of 1083 nine to 13 year old children, which was conducted in February and March 2007.

KEYWORDS

Internet, Safety, Children

1. INTRODUCTION

There is much concern among parents, educators and policy makers regarding the dangers that internet usage poses to children. In the absence of scientific research, the information void is being filled by the popular press (Carrington 2008), who tend to produce inaccurate and overly negative accounts of the risks that internet usage poses to young children. Carrington states that *"there is a clear positioning of children as innocent and gullible and the construction of a gulf between adult and child in terms of awareness of risk and victim-predator status"* (Carrington 2008, p. 156). Carrington reports that this knowledge gap is causing many adults to take a negative approach toward technology and *"the huge issue that teachers, parents, politicians and school administrators make about digital technology is for their own benefit"* (Carrington 2008, p. 163). Hope, too, believes that the internet risk debate is being manipulated by certain lobbies. Hopes reports that many older people struggle with the new technologies that children tend to be very comfortable with (Hope 2006). Cizek agrees, stating that *"many teachers feel that their students know more about the technology than they do and, as a result, feel threatened by the technology"* (Cizek 1999, p. 406). Cizek states that that teachers who feel threatened by technology *"are reluctant to adopt and use the technology"* (Cizek 1999, p. 406). Valentine states that adults' fears *"are fears about knowledge rather than violence"* (Valentine 2001, p. 72). Carrington states that *"as the technological gap between some adults and children continues to open, there will be increasing amounts of discomfort over young people's use of technologies and the public spaces they make accessible"* (Carrington 2008, p. 157).

The need for research into the risks that primary school children face while using the internet has been identified by other researchers. Hope states that there has only been *"some limited discussion of the issue of children and internet risks"* and that *"risk arising from school internet use is a largely neglected issue that needs urgent attention"* (Hope 2006, p. 312).

1.1 Context

As technology is becoming increasingly available and progressively more important in our daily lives, the internet are being increasingly adopted into schools. Condie states that *“the evidence gathered has shown a steady increase in the number of computers and other technologies”* being used in schools (Condie 2007, p. 3). Reflecting upon the importance of computer and internet usage skills, Carrington states that the increased usage of computers and the internet requires *“a concerted effort to ensure that all children in our school systems are provided with opportunities to engage in these new forms of textual and social practice”* (Carrington 2008, p. 165).

It is very important that children start to familiarize themselves with the internet from a young age. Carrington states that *“because young people are born into a world saturated in digital technologies they require literacy practices and skills oriented to multimodality”* and *“to focus on print as an a priori requirement is increasingly a disservice, particularly to those students most at risk of poor outcomes from schooling”* (Carrington 2008, p. 165).

The sea of information and learning activities available on the internet has the potential to greatly help in the development of young minds. Venezky states that *“by giving all schools access to an expanding world of resources, both teaching and learning can be advanced to a new level of effectiveness and social importance”* (Venezky 2004, p. 3). Haugland, citing earlier research, suggests that introducing computers into the classroom can improve students’ motor skills, enhanced mathematical thinking, increase creativity, increase critical thinking and problem solving, improve language skills, enhance children’s self-confidence and communication skills (Haugland 1999). Haugland also states that children who use computers share leadership roles more frequently and develop positive attitudes toward learning. Whitehead agrees with this view, reporting that computer usage can lead to increased student writing, enhanced cooperative learning, enhanced integration of curriculum, greater application of learning style strategies, increased applications of cross-age tutoring, increased teacher communication, enhanced community relations and enhanced global learners (Whitehead 2002).

However, the question remains as to how safe an environment the internet is for young children. Wishart states that there is *“worldwide concern for the safety of young Internet users”* (Wishart 2004, p. 193). Children can be targeted by a wide number of internet risks, such as exposure to illegal or harmful material, receiving unsolicited messages and being lured into a physical encounter (NCTE 2002).

2. ONLINE SAFETY

Personal safety is a major issue when it comes to children using the internet. According to a report published by the Irish National Centre of Technology in Education, there are three primary categories of risk associated with children using the internet (NCTE 2002):

1. Exposure to illegal or harmful material;
2. Receiving unsolicited messages;
3. Being lured into a physical encounter.

2.1 Exposure to Illegal or Harmful Material

Children using the internet face the risk of exposure to *“hate, violence, misinformation, consumer exploitation and sexual predators”* (Berson 2003, p. 10). Berson states that *“without much effort, a child may inadvertently or deliberately be exposed to on-line content that is obscene, pornographic, violent, racist, or otherwise offensive”* (Berson 2003, p. 10). Others agree with Benson’s argument that the relatively unregulated nature of cyberspace means that sexually explicit discussions, pornography, racial and ethnic hatred, Neo-Nazi groups, and pedophiles can all be found on the internet (Squire 1996; Whine 1997; Britton 1998; Hope 2006; NCH 2006). Exposure to such material can occur unintentionally when searching for educational content about people or places. Wolak found that 42% of adolescents surveyed had been exposed to online pornography in the past year. Of those, 66% reported unwanted exposure (Wolak 2007). Exposure

to illegal or harmful website content can have a serious negative effect on a child's behavior or attitude. Ybarra states that *"unwanted online sexual solicitation is one such online experience that may affect the health and functioning of a young person"* (Ybarra 2004).

Pupils who deliberately search for sexually explicit material on the internet will have no difficulty in finding it. In a survey conducted on behalf of the Irish Department of Education and Science, it was reported that 35% of the 848 children surveyed had visited pornographic websites (NCTE 2006).

2.2 Receiving Unsolicited Messages

Cyber bullying can happen through the use of email, text messages, chat rooms, mobile phones, mobile phone cameras and websites (Campbell 2005). Although cyber bullying may not be of the physical kind, it is an extreme form of mental bullying, which can lead to the physical harm of an individual. Willard reports that cyber bullying can cause devastating effects to young children (Willard 2006). Willard reports that the effects of cyber bullying include low self-esteem, poor academic performance, depression, and, in some cases, violence, even suicide. Hinduja agrees with Willard, stating that *"this negative experience not only undermines a youth's freedom to use and explore valuable on-line resources, but also can result in severe functional and physical ramifications"* (Hinduja 2008, p. 129).

Because of the widespread use of the internet, cyber bullying has increased dramatically in recent years. The NCH reports that one in every five school children is the victim of cyber bullying (NCH 2005). Li reports similar findings, with one in four school pupils saying they are the victim of cyber bullying (Li 2006). A study by Sharriff found even more worrying results, with 60% of students reporting they had been ignored by peers online, 50% saying they had been disrespected, 30% saying they had been called names, and 21% saying they had been threatened (Sharriff 2007). Sharriff states that *"cyber bullying is especially insidious because of its anonymous nature"* and *"it is dangerous because it most often takes place outside school hours on home computers, making it difficult, if not impossible, to supervise"* (Sharriff 2007, p. 77).

2.3 Being Lured into a Physical Encounter

Internet grooming *"involves a clever process of manipulation, typically initiated through a nonsexual approach, which is designed to entice a victim into a sexual encounter"* with an adult (Brown 2001, p. 11). Davidson reports that sex offenders will often socialise and groom children over long periods of time. Davidson states that grooming *"involves a process of socialisation during which an offender seeks to interact with the victim (and sometimes the victims family), to share their hobbies and interests and to become a part of their life, in order to prepare them for abuse"* (Davidson 2005, p. 4). Davidson also reports that the *"grooming of a child is often a slow process and certainly a deliberate process, it is much easier to abuse a child when trust is established"* (Davidson 2005, p. 4-5). The NCH agree with Davidson, stating that *"generally they [sexual predators] will seek to develop a relationship with the child or young person with a view to meeting up with them in real life"* (NCH 2006, p. 3).

The anonymity of the internet makes it is easy for an adult to impersonate a child and lure children into a physical encounter. The most serious risk of internet usage *"most serious risk involves the possibility of a child being lured into a physical encounter with someone they've met online"* (NCTE 2002, p. 10). According to Berson *"The perceived anonymity of the Internet has benefited pedophiles and provided an environment conducive to the exchange of pornography, identification of children to molest, sexual interactions with youth, and support and validation from other adults who share their sexual preferences"* (Berson 2003, p. 11). Pedophiles find security by operating within the confines of their own homes, from where they can groom children with the intention of meeting them in real life (Davidson 2005).

In a survey conducted on behalf of the Irish Department of Education and Science of children's use on the internet, 7% of the surveyed pupils aged between nine and 16 years old had met someone in real life that they first met on the internet (NCTE 2006). Of the children who had met an online contact in real life, 24% said that the person they met had introduced themselves as children on the internet, but had turned out to be adults in real life.

Not all researchers agree that children are at imminent risk of sexual predators when using the internet. Carrington, quoting Bob Sullivan, a technology correspondent at MSNBC, states that *"experts could not cite a single case of a child predator hunting for and finding a child through a blog"* (Carrington 2008, p. 155).

2.4 Childhood Developmental Factors that Contribute to Online Risk

Ybarra believes that children will continue to use the internet, irrespective of the dire warnings that they receive from adults. Ybarra states that *"it may not be feasible to change the entire online culture, and the promotion of prevention messages that contradict or fail to recognize widely accepted online behavior may lack credibility with youth"* (Ybarra 2007, p. 142). Ybarra suggests that *"instead of imparting the message 'don't talk to strangers online,' a harm reduction approach may be more effective"*. Ybarra believes that it can be okay to talk to strangers while online. Ybarra suggests that children only come into danger when they engage in "risky" behavior, such as talking about sex or behave aggressively toward others while online.

Oswell believes that not all children are victims. Oswell categorises children into three categories: child-as-victim, the child-in-danger and the dangerous child (Oswell 1998). Hope states that Oswell's categories *"allows for the idea that young people are not only possible victims but also potential offenders"* (Hope 2006, p. 313).

Wolak believes that many young victims of online consensual sexual crimes may not see themselves as being victims. They do not believe that either they or their adult partner are doing any harm. Wolak states that most victims of sex crimes are *"young teens who are willing to enter into voluntary sexual relationships with adults whom they meet online"* (Wolak 2004, p. 18). For many troubled children, the internet provides them with the affection and attention that they lack in the real world. Wolak states that *"half of the victims"* of online child sexual abuse *"were described as being in love with or feeling close bonds with the offenders"* (Wolak 2004, p. 11).

Wolak found that most sex offenders *"did not deceive victims about the fact that they were adults who were interested in sexual relationships"* (Wolak 2004, p. 11). Willard agrees with Wolak in the belief that many children are willing to have sex with adults. Willard suggests that predators do not need to be snatching kids by piecing together clues from personal information when they can go for the "low-hanging fruit" - the teens specifically engaging in at-risk behavior, such as posting sexually provocative images in their profiles (Willard 2007). Wolak suggests that educating children about the potential long-term detrimental effects of underage sex might achieve better results than simply advising children not to talk to strangers online.

Peer pressure and group dynamics play a role in children's online behaviour. Ybarra states that *"the role of friends in many online behaviors should be acknowledged. More than 40% of online risky behavior occurred while youth were using the Internet with friends or peers"* (Ybarra 2007, p. 144).

Wolak reports that having *"home internet access and high levels of internet use were related, independently of each other, to forming close online relationships"* (Wolak 2003, p. 115). Krauss reports that *"Both males and females with Internet access were also found to report significantly lower ages of first sexual intercourse than participants without internet access"* (Kraus 2008, p. 166). This matches previous findings that show how children who are exposed to sexually explicit material on television are more accepting of premarital sex, more likely to misjudge the prevalence of sexual activity, less likely to value the concept of marriage and monogamy, and more likely to consider sexual activity without emotional commitment (Zillman 1988; Zillman 1988b; Collins R. 2004).

The children who are at greatest risk of being bullied or sexually abused online tend to be the same children who are at risk in the real world. Wolak states that children are more vulnerable to online victimization if they are *"highly troubled, reported high amounts of conflict with their parents, low communication with parents and engaged in high levels of delinquency"* (Wolak 2003, p. 110). These children are more likely than the general population to seek online friendships or romances.

Ybarra believes that concerns about young children exposing themselves to pornography on the internet may be overstated (Ybarra 2005). Ybarra's research shows that 87% of children who seek out pornography are at least 14 years old, which is an age when one would be expected to be sexually curious. Ybarra's results suggest that younger children do not seek out pornography.

3. SURVEY

The author conducted a survey into some of the internet usage behavioral patterns that might result in primary school children being exposed to personal safety risks while using the internet. The instrument used to gather data was a quantitative survey. 1083 children from ten primary schools in County Louth, Ireland, took part in the survey. The surveyed children ranged in age from nine to 13 years old. Data for this survey was collected in February and March 2007.

Two factors contribute to the reliability of the survey. Firstly, respondents' confidentiality was ensured. There was no reason for the children to give dishonest answers to the survey questions. Secondly, the survey was conducted in ten different schools and the data from all ten schools correlated. In addition, both urban and rural schools were represented in the data. This suggests that the data is reliable.

There are two major data gathering weaknesses inherent in the data used in the survey. Firstly, the data collected in this survey was not randomly selected. Instead, the author got access to schools via personal contacts. Secondly, the sampled schools were clustered in one county. Both of these weaknesses mean that it is unsafe to make generalizations for the entire national pupil population based on the findings of the survey.

3.1 Survey Results

The results from the survey show that internet usage increases as pupils progress through class stages. The percentage of students who report using the internet at least two times a week ranges from a low of 37% in 3rd class and 43% in 4th class up to a high of 64% in 5th and 66% in 6th class (see Table 1). Other studies, such as that conducted by NSBF (NSBF 2000) and NCES (NCES 2003) also find an increase in internet usage as children become older.

The results from the survey show that boys and girls are as likely as each other to use the internet in any year. Weiser finds similar results (Weiser 2000). In addition, Weiser states boys tend to use the internet for entertainment while girls use it for communication.

Table 1. Internet usage, by class stage

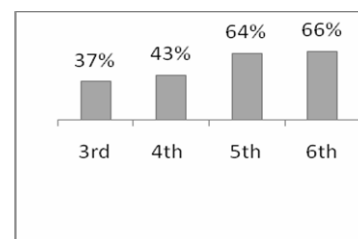
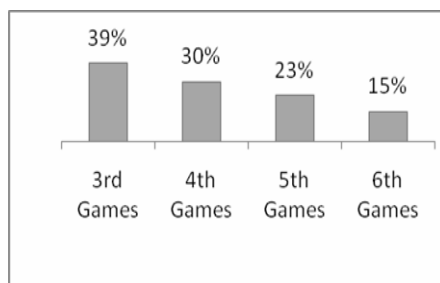
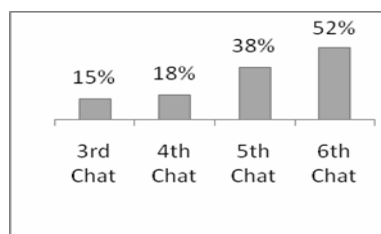


Table 2. Rate of downloading games, by class stage



In order to determine what primary school children use the internet for, the survey asked pupils which activities they used the internet for. Pupils were allowed to select zero or more of the follow six activities: searching sites; downloading games; downloading music; emailing friends; talking to people in chat rooms; and writing blogs. As they get older, children tend to move away from passive internet activities toward more interactive internet activities. As they get older, fewer children partake in the passive activity of downloading games (see Table 2). There is not a significant difference in the number of pupils who participate in the passive activity of downloading music.

Table 3. Rate of chat room usage, by class stage



On the other hand, interactive activities, such as searching the internet and emailing friends, all show a gradual increase as children get older. Chat rooms, which are the most interactive activity listed, show the most dramatic increase in rate of usage as pupils get older. Chat rooms usage rates change from 15% of pupils in 3rd class up to 52% of pupils in 6th class (see Table 3). The trend of students to move from passive to more interactive online activities as they get older is also found by NCES (NCES 2003). This finding suggests that children will be potentially more at risk as they get older, as it is only then that they engage in interactive activities on the internet.

In order to determine what information primary school children believe is safe to put online, the survey asked pupils to identify what personal information they believed it was okay to put online. Pupils were allowed to select zero or more of the following nine items: name; nickname; age; address; town; phone number; email address; photograph; and group photograph. As they get older, children tend to be more aware of the type of information that they should not put online. Carrington also finds that older children appear to be aware of what personal information is appropriate to place online (Carrington 2008). As they get older, there is a gradual decline in the number of children who think that it is correct to put their name, age, address, phone number or email address online. The biggest declines occur in the willingness of older children to place either their address (see Table 4) or their phone number (see Table 5) online. This finding suggests that, as children get older, they become more aware of the potential dangers that exist on the internet. When considered together with the finding that children are potentially more at risk as they get older, this finding should be reassuring.

Table 4. Willingness to divulge address, by class stage

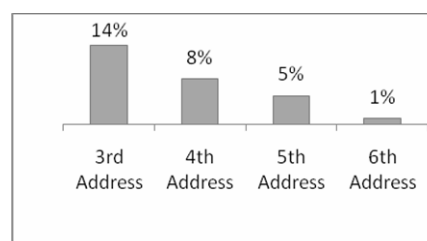


Table 5. Willingness to divulge phone number, by class stage

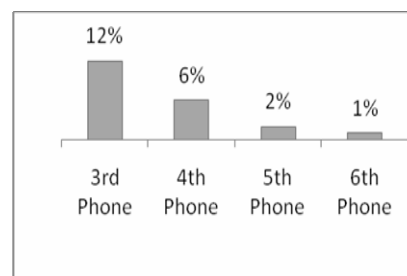
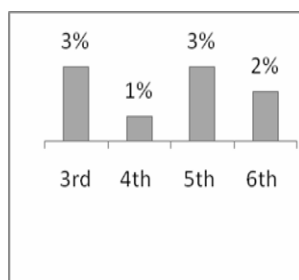


Table 6. Willingness to talk to strangers online, by class stage



In order to determine if primary school children know whom it is safe to talk to online, the survey asked pupils to identify which of the following three categories of people it was okay to communicate with online. Pupils were allowed to select zero or more of the following three items: people you know; strangers who are your own age; and strangers who are older than you. The survey reveals that less than 3% of 3rd class, 1% of 4th class, 3% of 5th class and 2% of 6th class pupils believe that it is safe to talk to strangers online (see Table 6). This finding suggests that the vast majority of children of all ages do not think that it is okay to talk to strangers online. This finding, when taken together with the fact that most children in the survey report that they do not divulge their personal details online, suggests that not all children are in serious imminent danger when they use the internet. This finding reinforces the need for objective research that can

better inform those in a position of authority. Objective research should result in the prioritizing of resources for the provision of online safety for those children who need the most help.

4. CONCLUSION

It is important that objective research be undertaken into the area of children's internet safety to allow the various stake-holders the opportunity to separate the actual and perceived risks that exist as a result of children using the internet.

Both the literature review and survey suggest that the level of risk that most children are exposed to is far smaller than is often suggested in the media. This is not to understate the very real and horrific experiences that some children encounter as a result of using the internet. What is important is that research into the area of the risks that are associated with children using the internet is objective. It does not benefit anybody to take a blinkered view of the argument.

A one-size-fits-all approach to children's internet safety is probably not the best policy to pursue. If policy makers, educators and social services were better informed, they might be able to properly target resources and provide the help that is needed for the children who are most vulnerable on the internet.

This research suggests that children's internet usage is dependent on age. Future research into children's internet safety should take greater consideration of the differences in internet usage that exist between various age groups.

It is the role of schools to educate children properly about internet safety. Wishart reports that it is generally accepted worldwide that schools have a fundamental role in ensuring the safety of their pupils while the pupils are online (Wishart 2004). Internet safety education should be given as high a profile as is given to educating children about the dangers that they face in the physical world.

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A COLLABORATIVE PROTOCOL FOR PRIVATE RETRIEVAL OF LOCATION-BASED INFORMATION

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ABSTRACT

Privacy and security are paramount for the proper deployment of location-based services (LBSs). We present a novel protocol based on user collaboration to privately retrieve location-based information from an LBS provider. Our approach neither assumes that users or the LBS can be completely trusted with regard to privacy, nor relies on a trusted third party. In addition, user queries, containing accurate locations, remain unchanged, and the collaborative protocol does not impose any special requirements on the query-response function of the LBS. The protocol is analyzed in terms of privacy, network traffic, and LBS processing overhead. We show that our proposal provides exponential scalability in the probability of guaranteed privacy breach, at the expense of a linear relative network cost.

KEYWORDS

Location-based services; private information retrieval; location privacy; trusted third parties; untrusted user collaboration

1. INTRODUCTION

The opening up of enormous business opportunities for location-based services (LBSs) is a result of the recent advances in wireless communications and positioning technologies. 3G technology makes mobile wireless communications faster than ever, and highly accurate positioning devices using GPS technology are widely accessible to the general public [7]. Due to the massive use of these technologies [2], an unprecedented amount of data is fleetingly traveling through high-speed networks from all over the world. Some of these data refer to users' private information such as their locations and preferences, and it should be handled carefully. The improper management of users' private data is a matter of considerable public concern and it could decelerate the deployment of LBSs. Location privacy and users' security are of paramount importance. If privacy and security issues are guaranteed, LBSs will become one of the most important representatives of the information and communications technologies (ICTs) in the 21st century.

The way LBSs are accessed by users is changing rapidly. The simplest form of information exchange in an LBS involves a user and an LBS provider P . The former sends a simple query Q containing some sort of identification information ID , their location L and a request for information I that the user wants to retrieve from P . Thus, a simple query sent from U to P may be $Q = \{ID_U, L, I\} = \{ID_U, x_U, y_U, \text{"Where is the nearest Italian restaurant?"}\}$. Fig. 1 depicts this communication scheme.

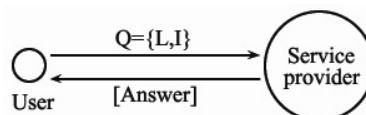


Figure 1. Simple communication scheme between an LBS user and an LBS provider.

When users send their current locations to the LBS, they are not always guaranteed that the LBS will manage their data honestly and will refrain from any misuse. Consequently, more sophisticated mechanisms for location-based information retrieval are needed, which must protect the users' privacy. Most of the solutions proposed in the literature to address the LBS privacy problem are based on trusted third parties (TTPs), i.e., entities which fully guarantee the privacy of their users. Although this approach is widely accepted, it simply moves users' trust from LBS providers to intermediate entities. By doing so, LBS providers are no longer aware of the real locations and identities of their users; trust, and by extension power are handed over to intermediate entities such as pseudonymizers and anonymizers. The problem is that users are not necessarily satisfied about completely trusting intermediate entities or providers, especially after the recent scandals related to the disclosure of personal data by this kind of trusted entities. See Fig. 2 for a graphical representation of TTP-based schemes.

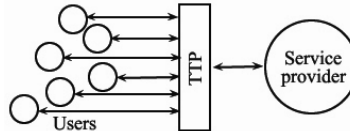


Figure 2. Communication scheme between an LBS user, an intermediate trusted entity and an LBS provider.

The main difference between the simple communication scheme depicted in Fig.1 and the TTP-based one [6,14] is that in the latter the set of intermediate entities can be expected to be smaller than the number of service providers. Therefore, intermediate entities can be well known and the risk of trusting a dishonest entity is reduced. Pseudonymizers are the simplest intermediate entity between LBS users and providers. Anonymizers [1,10,13,14] are the most sophisticated option in TTP-based location privacy. However, many users would prefer to trust nobody and, consequently, TTP-free schemes [3,4,5,11,12] enter the arena. These represent a substantial change of paradigm. See Fig. 3 for a graphical representation of a TTP-free scheme. Instead of trusting a third party, users collaborate to protect their privacy. Moreover, there is no need to trust the users one collaborates with.

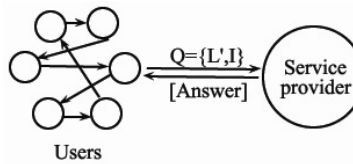


Figure 3. Communication scheme between a set of collaborative LBS users and an untrusted LBS provider. Location information may not be the real one (L), but a perturbed one (L'). No TTP is used.

1.1 Contribution and Plan

In this paper, we present a novel approach to privately retrieve location-based information from an untrusted LBS provider. Our method does not rely on TTPs but on the collaboration among multiple users to achieve privacy, despite the fact that users may not be completely trusted. Instead of defining common cloaking areas into which users become anonymous or sharing a perturbed bogus location, our method mixes queries from many users and prevents LBS providers from knowing which query refers to user. One of the main strengths of the protocol is that it benefits from an exponentially decreasing probability of guaranteed privacy breach, at the expense of only linearly increasing relative communication costs, with respect to the size parameters of the trellis. We provide a theoretical analysis of the probability of coincidental privacy breach. Furthermore, we carry out Monte Carlo simulations to verify the theoretical results and to investigate policy modifications of our protocol.

The rest of the paper is organized as follows. Sec. 2 presents our protocol for private, TTP-free, location-based information retrieval through user collaboration. The theoretical analysis of this protocol in terms of privacy is developed in Sec. 3 while the Monte Carlo simulation analysis is developed in Sec. 4. Finally, conclusions are drawn in Sec. 5.

2. A COLLABORATIVE PROTOCOL FOR PRIVACY IN LBSs

In this section we present a collaborative protocol that enables a number of users to interact with an LBS in a way that protects the privacy of their queries and replies. This is achieved in spite of two assumptions. First, it is assumed that neither the LBS nor other cooperating users can be completely trusted regarding the disclosure or a user's private information. Secondly, both the queries and the replies contain accurate information that may not be perturbed. Sec 2.1 makes our assumptions more precise. The privacy protocol proposed is described in Sec. 2.2, which relies on the existence of a cooperative structure of users.

2.1 Assumptions

In the following, we describe the assumptions on which our collaborative privacy protocol has been built:

- Users are allowed to cooperate but no party can be completely trusted, thus no TTP is available.
- Queries sent to the LBS must be kept private and accurate, thus they may not be perturbed. In particular, noise may not be added to the users' accurate location information to protect their privacy.
- The privacy protocol must be completely transparent to an arbitrary query-response function implemented by the LBS. This prevents, for instance, the use of cryptographic mechanisms operating on the assumption of a reduced response space, or a lookup table implementation of the query-response function.
- Knowledge of the user ID is inherent to the communication system, and no form of anonymization is possible, through a TTP or otherwise. IDs may neither be shared nor exchanged among users.
- Communication between any two parties is confidential and authenticated.
- Messages exchanged between users may be encrypted for the LBS to further strengthen confidentiality. In practice, this would require that the LBS participate in any collusion against a user's privacy.

Clearly, the last two hypotheses may be satisfied by the existence of a public key infrastructure (PKI), not necessarily online. The very last requirement, in particular, could be fulfilled by encrypting messages with the public key of the LBS.

Finally, we shall assume the existence of a secure mechanism by means of which users may organize themselves and adhere to a privacy protocol involving certain message exchanges. Particularly, we shall assume that there is a way to create and efficiently maintain collaborative structures, which is robust against denial-of-service attacks.

The creation and maintenance of the trellis structure is detailed in [9]. Creating and maintaining the ad hoc network structure needed for our protocol has been shown to be feasible with a small number of nodes. This may be sufficient in practical applications because our proposal does not need a large number of participants, due to the exponentially low likelihood of privacy breach. However, an interesting challenge arises from the fact that the protocol may be improved by devising a completely secure and more efficient mechanism to create and maintain collaborative structures, and to enforce the privacy protocol presented, in particular against denial of service attacks, and for large-scale structures [8].

We shall see that the LBS receives a list of queries, some of them forged, together with a list of subscriber IDs. This allows billing systems based either on flat fees or on the number of queries submitted, while preventing billing based on privacy-sensitive properties such as query length.

2.2 Query Permutation on a Trellis of Users

Consider first the simplest case when a single user must access an LBS. One way to ensure that the LBS is unable to completely ascertain the user's actual information interests is for the user to accompany his queries with forged ones. Unfortunately, this may represent a significant overhead in terms of network traffic and LBS processing.

To preserve privacy at a reasonable network and LBS processing cost, we propose the following protocol, based on query permutation in a trellis of users. More specifically, users form a trellis of m rows and n columns as shown in Fig. 4.

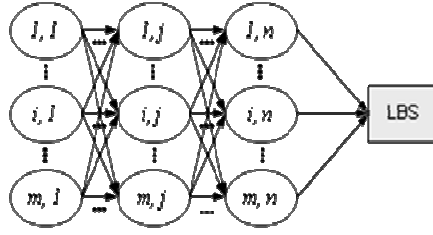
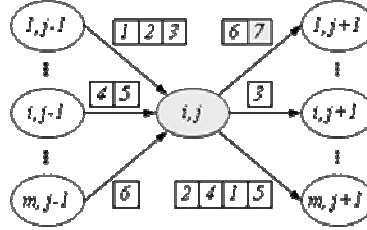


Figure 4. Query permutation on a trellis of users.

In this setting, only users in the first column generate forged queries and send them along with their authentic queries to users in the second column. In general, as illustrated in Fig. 5, user (i,j) in row i and column j receives permuted queries from users in column $j-1$ when $j > 1$, or forges queries when $j=1$. Next, the user adds their own query, permutes the resulting list, and finally, splits it and sends each part to different users in the following column $j+1$ if $j < n$, or to the LBS if $j=n$. The choices regarding the permutation of the list, its splitting, and the users the parts are sent to, may be random.

Figure 5. User (i,j) adds their own query to those received from the previous column, permutes the resulting list, splits it and sends the parts to users in the next column.

For $1 < j < n$, in order to guarantee that the privacy of user (i,j) be completely compromised regardless of how queries are split and transmitted, it seems that $2m$ users, namely all users from the previous column and the next one, must collude. However, $m+1$ users are enough if we are satisfied with the coincidental configuration where all users in column $j-1$ collude with the user in column $j+1$ which happened to receive the query.

2.3 Query Forwarding Policies

Intuition suggests that the random query forwarding policy may be improved by enforcing maximum diffusion of queries from a user to the column of recipients. For example, if (i,j) has at least m queries, sending at least one to each of the users in $j+1$ may have a positive impact in terms of probability of privacy breach. We shall see this is the case in the experiments reported in section 4. Such policy guarantees that nodes in $j+1$ do not need to generate forged queries to protect their privacy against users in $j+2$. On the other hand, nodes in the first column would still need to forge $m-1$ queries each, to enforce this throughout the trellis.

More generally, it is possible to carry out the protocol described in this section in slightly different ways, with consequent variations in performance in terms of privacy and number of messages. For example, for $1 < j < n$, user (i,j) could split its own query into portions sent to all users in column $j+1$. In this way, a single malicious user in the next column does not suffice for a complete privacy breach. These portions should be properly tagged in order for the LBS to recombine them. However, if all users in column $j+1$ are malicious, they could keep track of the recombination tags to discard incomplete groups of query portions coming from (i,j) , in order to compromise the user's privacy. At the other extreme, an alternative to reduce the number of messages would consist in sending the entire query list to a single, randomly chosen user from the next column.

3. THEORETICAL ANALYSIS OF PRIVACY AND COST

In this section we analyze the trellis structure described in Sec. 2.2 in terms of two contrasting aspects. On the one hand, we consider the usefulness of this structure to preserve the users' privacy and carry out simulations for two simple policies. On the other, we study the overhead cost in regard to network connections, traffic and LBS processing.

3.1 Privacy

Interested in a conceptual, preliminary analysis, we shall simply assume that users disclose their lists of queries and are willing to collude with other users to compromise a given user's privacy, with identical probability $1-t$, independently from each other, conditioned on the event that the LBS is willing to act maliciously as well. Loosely speaking, t is the probability that a user can be trusted, given that the LBS cannot. Conditioning on the event that the LBS is malicious makes the computation identical regardless of whether queries are encrypted for the LBS, and yields slightly simpler expressions, omitting a constant factor, namely the probability that the LBS acts maliciously. More realistic scenarios could of course be better characterized by more complex probability models. Finally, our privacy analysis focuses only on queries, rather than replies, due to the similarity of the alternative analysis.

Privacy is not completely compromised as long as a list of queries contains at least one query in addition to the user's. Provided that users in the first column of the trellis of Sec. 2.2 submit forged queries, any group of colluding users will be unable to ascertain authentic queries, at least without further statistical analysis.

For $j > 1$, consider the case when user (i, j) 's query is known to a group of users colluding with each other and the LBS. The probability that this situation is guaranteed to happen regardless of how query lists are split and transmitted, requires collusion of the $2m$ users in columns $j-1$ and $j+1$, or merely the m users in column $j-1$ if $j=n$. This probability of *guaranteed complete privacy breach* (GCPB) is $p_{\text{GCPB}} = (1-t)^{2m}$ for $1 < j < n$, and $(1-t)^m$ for $j=n$. By definition p_{GCPB} is a probability conditioned on the event that the LBS acts maliciously, in cooperation with the group of colluding users.

It is shown in [9] that under the mild assumption of symmetry and random query forwarding, the probability of *coincidental complete privacy breach* (CCPB) is, for $1 < j < n$,

$$p_{\text{CCPB}} = (1-t) \sum_{b_1=0}^m \dots \sum_{b_{j-1}=0}^m \left(\prod_{k=1}^{j-1} \binom{m}{b_k} \right) t^{\sum_{k=1}^{j-1} b_k} (1-t)^{m(j-1) - \sum_{k=1}^{j-1} b_k} \times \\ \times \left(1 - \frac{\prod_{k=2}^{j-1} b_k}{m^{j-1}} \right)^{b_1(1+f)} \prod_{k=2}^{j-1} \left(1 - \frac{\prod_{l=k+1}^{j-1} b_l}{m^{j-k}} \right)^{b_k} . \quad (1)$$

The same work proves the approximation for $t \approx 1$

$$p_{\text{CCPB}} = (1-t) \left(1 - \frac{1}{m} \right)^{m(j+f-1)} + o(t-1). \quad (2)$$

3.2 Network Cost

Regarding network costs, [9] shows that the number of connections and query messages which are required by our protocol in the m -by- n trellis is $O(m^2 n)$, and the total number of queries transmitted through the trellis is $O(m n^2)$. Relative to the minimum of $m n$ attained in an ideal scenario with benign participants, the corresponding overhead is linear, precisely, $O(m)$ and $O(n)$ respectively. Provided that users in the first column generate a fixed number of queries, the total number of queries processed by the LBS is $O(m n)$, and the relative overhead is asymptotically 1. In [9] we describe simple variations of the protocol to remove the need for forged query processing altogether. In addition, the privacy protocol is completely transparent to the implementation of the query-response function in the LBS. This is an advantage with respect to cryptographic PIR mechanisms operating on the assumption of a reduced response space, for instance, a lookup table implementation of the query-response function.

4. EXPERIMENTAL ANALYSIS OF PRIVACY

We simulated two query forwarding policies for the trellis structure described in Sec. 2.3, using the Monte Carlo technique. In the first policy users randomly forward the queries that arrive to them from the previous column. In the second policy users spread queries as much as possible. It can be seen in Fig. 6. that lower probabilities of privacy risk are obtained by spreading. After simulation of the mentioned policies, it can be seen that as t increases, the spreading policy further reduces the probability regardless of the variation of m , j and f . The probability is reduced drastically as m increases but not as significantly with f when the trust probability of users is high. Furthermore, it can be considered that probabilities obtained with random forwarding policy are close to the theoretical probability of CCPB of equation (1), unlike maximum spreading policy, which is considerably lower.

The following plots show averages of 10 000 simulated outcomes. When the experimental result is far from the theoretical probability, it means that the number of simulated outcomes yields insufficiently accurate averages. As a consequence, if the simulation with random forwarding is not accurate, neither will be the simulation with spread forwarding.

As for the graphic representation of the theoretical probability, the plots of Fig. 6 also suggest that larger m and f help reduce p_{CCPB} , in keeping with the exact formula (1). For trustworthy users, p_{CCPB} decreases exponentially with j and f , but approaches a saturation level for large m . This phenomenon is supported by the curves depicted for $t=9/10$ in Fig. 6. The intraquery splitting alternative commented on in Sec. 2.2 may be an additional degree of freedom in the protocol to alter the probability of CCPB, but the probability of GCPB will remain equal to $(1-t)^{2m}$. While both probabilities can always be reduced by generating additional forged queries at intermediate nodes, this comes at the cost of network traffic, and LBS processing time.

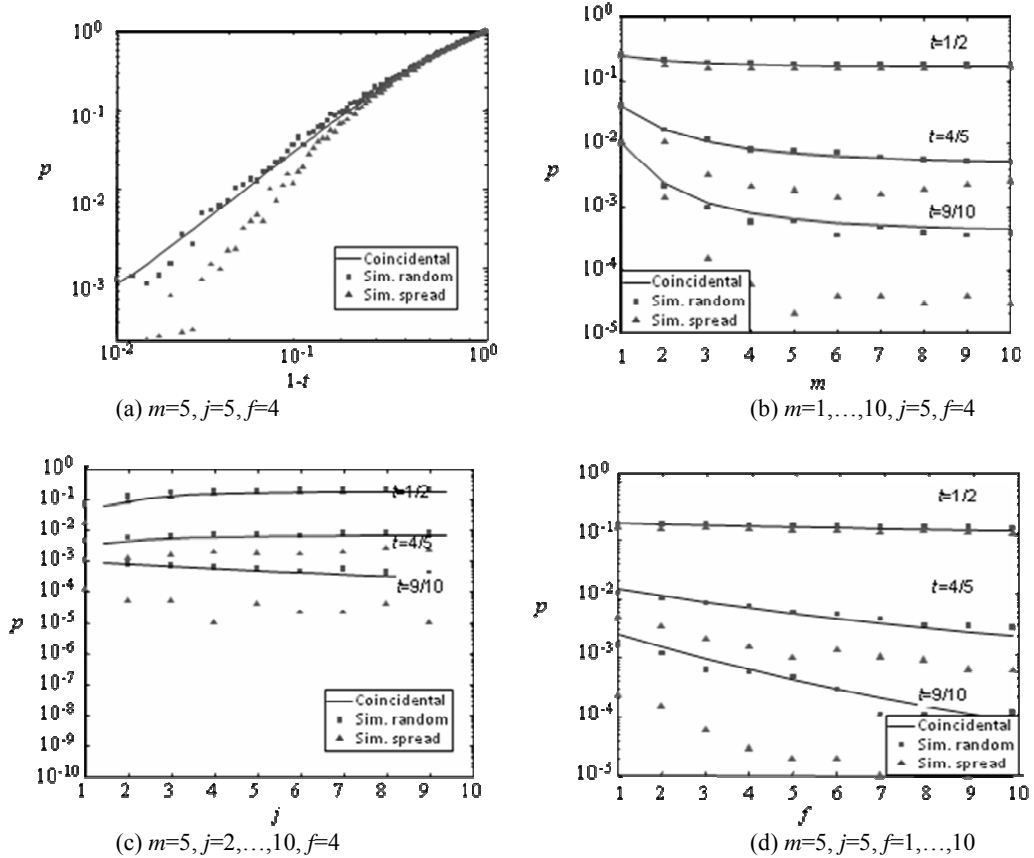


Figure 6. Probability of CCPB(1), and simulation of the protocol with random forwarding and maximum spread forwarding.

5. CONCLUSION

Location-based services are undoubtedly essential representatives of the ICTs. Due to their inherent capability to infer private information from LBSs users, techniques to protect the user privacy are of paramount importance. In this work, we have proposed a collaborative privacy protocol for LBSs that despite not requiring TTPs, is highly scalable in terms of privacy risk. Precisely, one of the main strengths of the protocol is that it benefits from an exponentially decreasing probability of guaranteed privacy breach, at the expense of only linearly increasing relative communication costs, with respect to the size parameters of the trellis.

More specifically, users group themselves into a trellis of m rows and n columns, where queries are exchanged and permuted in such a way that privacy is preserved throughout to a scalable degree. In fact, complete privacy breach is only guaranteed under the collusion of $2m$ users together with the LBS, increasingly unlikely with large m . There exists a tradeoff between privacy and latency, due to the fact that users must wait for others to cooperate before sending their queries, and that a latency constraint in turn imposes an upper bound on the average number of participants in the trellis. Creating and maintaining the ad hoc network structure needed by our protocol has been shown to be feasible with a small number of nodes and sufficient for practical applications.

Furthermore, the probability was simulated following two policies. First, forwarding queries to the next column randomly, and secondly, spreading them as much as possible. The Monte Carlo simulation concluded that spreading leads to lower probabilities of privacy risk. It can be seen that as t (trust probability) increases, the spreading policy further reduces the probability regardless of the variation of m (number of users in a row), j (user column index) and f (number of queries sent by a user of the first column). The probability is reduced drastically as m increases. However, the dependence of the probability is not as significant on f , especially for high values of t . Furthermore, it can be considered that probabilities obtained with random forwarding policy are close to the theoretical probability of CCPB, unlike maximum spreading policy, which is considerably lower.

ACKNOWLEDGEMENT

This work was partly supported by the Spanish Government through projects CONSOLIDER INGENIO 2010 CSD2007-00004 “ARES”, TSI2007-65393-C02-02 “ITACA” and TSI2007-65406-C03-01 “E-AEGIS”, and by the Government of Catalonia under grants 2005 SGR 00446 and 2005 SGR 01015.

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PRIVACY IN INTERNET AGE: THE INDICATION TO CHINA'S INTERNET PRIVACY PROTECTION FROM INTERNET PRIVACY REGULATIONS OF THE UNITED STATES AND THE EUROPEAN UNION

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ABSTRACT

Facing the privacy infringement caused by information technology development, every country dedicates to establishing its legal protection system on internet privacy. This paper discusses the internet privacy legal protection approaches and regulations in the United States and the European Union from the comparative research perspective, and provides legislation suggestions for the internet privacy protection in China.

KEYWORDS

Internet privacy, Protection approach, Indication

1. INTRODUCTION

In 1890, the right to privacy was first mentioned by American jurists Samuel Warren and Louis Brandeis in the article *The Right to Privacy* published on *Harvard Law Review*. Thereafter, the right to privacy was gradually confirmed and protected by law as one of the most important parts of human rights. With the rapid development of internet and information technology, individual privacy rights on the internet are being eroded seriously. In response to the erosion, there is a growing trend around the world towards the establishment of comprehensive protection system on internet privacy rights.

This article intends to give a proposal for internet privacy protection in China from the comparative research on internet privacy regulations of the United States and the European Union. Part II introduces the issue of privacy. Part III examines internet privacy regulations in the United States, focusing on the constitutional protection of privacy rights and the passage of privacy acts. This section also analyzes the current United States internet policy of self-regulation. Part IV discusses internet protection regulations in the European Union, concentrating on the European Data Protection Directive which became effective on October 25, 1998. Part V compares the internet privacy protection between the United States and the European Union, discussing their advantages and disadvantages respectively. Part VI analyzes current internet privacy protection in China and its defectives, and gives several suggestions on the improvement of China's internet privacy protection. Part VII ultimately concludes that China should learn experience from the United States and the European Union to create a comprehensive internet privacy protection system.

2. PRIVACY ON THE INTERNET

2.1 Privacy Rights on the Internet

Privacy is not a straightforward concept and, therefore, is difficult to define. It is not a single interest, but rather has several different dimensions. Privacy can be divided into four general facets: 1) information privacy; 2) bodily privacy; 3) privacy of communications; and 4) territorial privacy. Undoubtedly, internet

privacy belongs to the areas of information privacy and privacy of communications.

With about 320 million internet users worldwide by the year of 2002, the protection of individual data information on the internet is one of the most important issues today. According to a number of surveys, internet users report that privacy protection is one of their greatest concerns.

In regard with the individual rights to privacy on the internet, there are five categories generally: 1) Right of knowledge; 2) Right of choice; 3) Right of control; 4) Right to request security; and 5) Right to request damages.

2.2 Invasion of Internet Privacy

Since internet technology provides companies with the ability to collect information from internet users and distribute that information to others, individual privacy in internet is easily invaded by webmasters.

Some webmasters have begun using “cookies” as a means of accumulating information about web surfers without having to ask for it. “Cookies” represent a coming effort by organizations to monitor peoples’ interest in their products and services through the covert gathering of personal data without their knowledge and consent. Generally, “cookies” allow websites to tag their visitors with unique identifiers so that they can be identified each time they visit the site.

By using “cookies”, some companies sell personal information they collect to gain lucrative profit, discarding their promise to internet users. America Online has been accused of selling data based information about users. Also, the Federal Trade Commission determined that Geocities, a popular website where users input personal information, was selling information in apparent violation of its own privacy policy.

3. INTERNET PRIVACY PROTECTION REGULATIONS OF THE UNITED STATES

Internet privacy in the United States is protected through a combination of constitutional guarantees, federal and state statutes and self-regulatory industry codes of conduct that apply to the public and private sectors in different ways.

3.1 Constitution

The United States Constitution does not specifically mention a right to privacy. However, some informational privacy protection can be found in the First and Fourth Amendments of the US Constitution under the interpretation of the US Supreme Court.

The First Amendment to the US Constitution provides: Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof; or abridging the freedom of speech, or of the press, or the right of the people peaceably to assemble, and to petition the Government for a redress of grievances.

Although the First Amendment may facially appear to be concerned solely with the free flow of information through its protections of free speech and free press, it also clearly protects some level of informational privacy.

As with the First Amendment, the Fourth Amendment to the US Constitution also protects informational privacy. The Fourth Amendment states: The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated, and no warrants shall issue, but upon probable cause, supported by oath or affirmation, and particularly describing the place to be searched, and the persons or things to be seized.

An individual’s right to privacy is protected under the Fourth Amendment’s prohibition against unreasonable searches and seizures when there is a reasonable expectation of privacy.

3.2 Privacy Act of 1974

As the basic statute to protect right to privacy, the Privacy Act of 1974 protects certain federal government

records pertaining to individuals. The Privacy Act of 1974 states that “no agency shall disclose any record which is contained in a system of records by any means of communication to any person, or to another agency, except pursuant to a written request by, or with the prior written consent of, the individual to whom the record pertains.” In general, the Privacy Act prohibits unauthorized disclosures of the records it protects. It also gives individuals the right to review records about themselves, to find out if these records have been disclosed, and to request corrections or amendments of these records, unless the records are legally exempt. Specific exceptions for the record allowing using personal records are: for statistical purposes by the Census Bureau and the Bureau of Labor Statistics; for routine uses within a US government agency; for archival purposes as a record which has sufficient historical or other value to warrant its continued preservation by the United States Government; for law enforcement purposes; for congressional investigations; and other administrative purposes. The Privacy Act mandates that each government’s agency have in place an administrative and physical security system to prevent the unauthorized release of personal records.

3.3 Information Privacy Statutes

Presently, there is no comprehensive law in the United States guaranteeing privacy rights in personal information. There are, however, various privacy and security statutes that address specific privacy needs. Among the various federal and state statutes, the most important one is the Electronic Communications Privacy Act promulgated in 1986.

3.3.1 Electronic Communications Privacy Act

Although vastly inadequate, the Electronic Communications Privacy Act (ECPA) is currently the most comprehensive data protection legislation that protects personal information on the Internet. The ECPA covers all forms of digital communication, including transmissions of text and digitized images, in addition to voice communication. The law prohibits unauthorized eavesdropping not only by the government, but by all persons and businesses. The ECPA also prohibits unauthorized access to messages stored on computer systems, and unauthorized interception of messages in transmission.

The ECPA contains numerous exceptions. The ECPA does not assure on-line system users’ privacy rights from system operators for stored messages. Since a system can be configured to store all messages that pass through it, the operator effectively has the ability to review all messages that pass through the system. Under the ECPA, it is illegal for a system operator to reveal stored private messages or users to anyone else. It is legal, however, to reveal messages falling under certain specific exceptions noted in the ECPA. For instance, a message sent to the operator himself can be disclosed, if he so chooses, since the operator is treated like any other recipient of a letter. Another exception involves divulging information to government authorities. A message that is accidentally obtained by a system operator can be disclosed to legal authorities if the operator believes that illegal activity is taking place over the system. Authorities then have the right to review these messages to the extent they deem necessary to confirm the system operator’s apprehensions.

If the system operator happens to violate a user’s privacy rights under the ECPA, such as posting private email to the public, the ECPA gives the user the right to sue the system operator. The system operator must then remove the public posting and can be held responsible for any monetary damages incurred as a result of the privacy violation. The ECPA also allows for recovery of attorney fees and criminal penalties.

3.3.2 Other Information Privacy Acts

In addition to the Electronic Communications Privacy Act, Congress has enacted several other acts protecting informational privacy. These acts include: Freedom of Information Act, Right to Financial Privacy Act, Fair Credit Reporting Act, Cable Communications Policy Act, Telecommunications Act, Telephone Consumer Protection Act, and Children’s Online Privacy Protection Act.

3.4 Self-regulation

Apart from numerous privacy acts, the United States prefer a policy of industry self-regulation. Basically, three kinds of self-regulatory programs are followed by the US industries at the present, namely, suggestive industry guidelines, online privacy seal program and technical protection.

3.4.1 Suggestive Industry Guidelines

Many industry alliances engaged in online services have issued industry principles to protect internet privacy. Among those industry alliances, Online Privacy Alliances is the most famous one, a diverse group of more than 80 global corporations and associations who have come together to promote business-wide actions that create an environment of trust and foster the protection of individuals' privacy online. It issued its online privacy guideline in 1998 based on the principle of the Federal Trade Commission's suggestions.

3.4.2 Online Privacy Seal Program

Different from suggestive industry guidelines that apply to identical industries, online privacy seal program is used among different businesses. It awards the privacy seal to businesses which have proven to meet the high standards set in the program requirements. Famous online privacy seal programs include TRUSTe, BBBOnLine, WebTrust, etc.

3.4.3 Technical Protection

Technical protection proffers infrastructures capable of being adapted to encourage or even mandate privacy-protective features. An example of technical protection is the World Wide Web Consortium's Platform for Privacy Preferences (P3P). P3P enables websites to specify their personal data use and disclosure practices, web users to specify their expectations concerning personal data disclosure practices, and software agents to undertake negotiations, on behalf of the parties, in order to reach an agreement concerning the exchange of data between them. Hence, an individual can have sufficient information to make an informed decision on whether to permit or refuse provision of personal data, and can even confidently delegate the decision to a software agent acting on their behalf.

4. INTERNET PRIVACY PROTECTION OF THE EUROPEAN UNION

Different from the United States, the European Union puts more emphasis on legislation to protect personal data information. Adopted by the European Union's Council of Ministers on October 24, 1995, the European Directive on the Protection of Individuals with regard to the Processing of Personal Data and on the Free Movement of Such Data (thereafter the European Union Directive on Data Protection) becomes the most important legislation on data protection of EU in the last decade. In addition, many other legislations concerning personal data protection also play a significant role in European internet privacy protection.

4.1 European Union Directive on Data Protection

Article 1 of the Directive states that "member states shall protect the fundamental rights and freedoms of natural persons, and in particular their right of privacy, with respect to the processing of personal data." Through this Article, the European Union has boldly deemed informational privacy a fundamental human right.

The Directive requires all of the European Union Member States to enact comprehensive privacy legislation that implements the following personal data policies:

4.1.1 Data Quality Requirements

Five general principles are included in the requirements. 1) Fairness/Lawfulness: personal data must be "processed fairly and lawfully". 2) Purpose limitation: personal data must be "collected for specified, explicit and legitimate purposes and not further processed in a way incompatible with those purposes". 3) Relevant: personal data must be "adequate, relevant and not excessive in relation to the purposes for which they are collected and/or for which they are further processed". 4) Accuracy: personal data must be "accurate and, where necessary, kept up to date; every reasonable step must be taken to ensure that data which are inaccurate or incomplete, having regard to the purposes for which they are collected or for which they are further processed, are erased or rectified". 5) Timely: personal data must be "kept in a form which permits identification of data subjects for no longer than is necessary for the purposes for which the data were collected or for which they are further processed".

4.1.2 Legitimate Processing Requirements

- 1) Consent: personal data may be processed only if “the data subject has given his consent unambiguously.”
- 2) Contract: personal data may be processed only if “processing is necessary for the performance of a contract to which the data subject is party or in order to take steps at the request of the data subject entering the contract.”
- 3) Legal obligation: personal data may be processed if “processing is necessary for compliance with a legal obligation to which the controller is subject.”
- 4) Vital interests: personal data may be processed if “processing is necessary in order to protect the vital interests of the data subject.”
- 5) Public interest and official authority: personal data may be processed if “processing is necessary for the performance of a task carried out in the public interest or in the exercise of official authority vested in the controller or in the third party to whom the data are disclosed.”
- 6) Legitimate interests: personal data may be processed if processing is “necessary for the purposes of the legitimate interests pursued by the controller or by the third party or parties to whom the data are disclosed, except where such interests are overridden by the interests or fundamental rights and freedoms of the data subject which require protection under Article 1(1).”

4.1.3 Rights of Data Subject

- 1) Right of access: every data subject has the right to obtain from the controller “confirmation as to whether or not data relating to him are processed and information at least as to the purposes of the processing, the categories of data concerned, and the recipients or categories of recipients to whom the data are disclosed.”
- 2) Correct/Block information: every data subject has the right to obtain from the controller “the rectification, erasure, or blocking of data, the processing of which does not comply with the provisions of this Directive, in particular because of the incomplete or inaccurate nature of the data.”
- 3) Right to object: every data subject has the right “to object at any time on compelling legitimate grounds relating to his particular situation to the processing of data relating to him.”

4.1.4 Security

The Directive requires the member states to “implement appropriate technical and organizational measures to protect personal data against accidental or unlawful destruction or accidental loss and against unauthorized alteration, disclosure or access.” The appropriate level of security is determined by balancing the nature of the data against the amount of risk involved in the processing of that data.

4.2 Other Legislations on Data Protection

As early as 1981, The Convention for the Protection of Individuals with regard to Automatic Processing of Personal Data of the Council of Europe extended the safeguards for everyone’s rights and fundamental freedoms, and in particular the right to the respect for privacy, taking account of the increasing flow across frontiers of personal data undergoing automatic processing.

5. COMPARISON ON INTERNET PRIVACY PROTECTION BETWEEN THE UNITED STATES AND THE EUROPEAN UNION

The United States relies largely on a self-regulatory approach to effective data privacy and protection. In contrast, the European Union views data privacy as a fundamental right that is best protected by legislation and federal policing. It was inevitable that this underlying difference in ideologies that would lead to apparent influence on internet privacy protection of the US and the EU.

As for the internet privacy protection of the US, the self-regulatory approach is undoubtedly beneficial for the development of internet information industry as well as for the growth of social economy on the one hand; but on the other hand, the loose requirement of webmasters’ obligation set by self-regulations will weaken the protection on internet users’ online privacy, thus, will potentially lead to invasion of internet privacy. On the contrary, the legislation approach of the EU focuses on the complete protection and respect of

personal privacy. Under this kind of approach, more restrictions are made for personal data collection, which will largely increase costs of information industry or even impede the development of internet.

In addition, the difference in ideologies also arouses a confrontation between the US and the EU regarding the transfer of personal data. The cornerstone of this struggle lies in Article 25 of the European Union Directive that became effective on October 25, 1998. This article prohibits data transfers to any country lacking an adequate level of protection, as determined by the European Union. In the European Union's opinion, the United States is one country that does not meet its standards for the protection of data privacy. In order to resolve this problem, a proposal has been issued under the effort of the United States Department of Commerce and European Commission. In this proposal, a "safe harbor" was created for the US companies that choose to adhere to certain privacy principles, thereby being deemed adequate for the purposes of data transfer. The so-called "safe harbor principles" deal with the areas of notice, choice, onward transfer, security, data integrity, access and enforcement.

6. INDICATION TO INTERNET PRIVACY PROTECTION OF CHINA

6.1 Internet Privacy Protection of China

In China, no independent data information statute governs internet information collection; it depends on traditional civil rights to protect personal data in internet. In the legal practice, right to privacy is not protected as an independent human right, but as a part of right to reputation.

The Constitution of the People's Republic of China protects privacy as a fundamental right. Article 40 states that "Freedom and privacy of correspondence of citizens of the People's Republic of China are protected by law. No organization or individual may, on any ground, infringe on citizens' freedom of privacy of correspondence, except in cases where to meet the needs of state security or of criminal investigation, public security or procuratorial organs are permitted to censor correspondence in accordance with procedures prescribed by law." Individual privacy is also protected to some extent under various legislations, such as Article 7 of the Computer Information Network and Internet Security Protection and Management Regulations, Articles 285 to 287 of the Criminal Code dealing with hacking or unlawful intrusion into computer systems, and the Practicing Physician Law which prohibits the disclosure of health information obtained during treatment with criminal sanctions.

Because of the rapid development of the internet in China, the Chinese government also passed a few regulations related to internet information security and privacy protection in 2000. For example, the Regulations on Administration of Internet Bulletin Board System (BBS) Service, passed by the Ministry of Information Industry in 2000, mandates that BBS service providers should keep the Internet users' personal information secret, and shall not reveal it to other parties unless otherwise provided under law. In addition, the Decision of the Standing Committee of National People's Congress on Internet Security passed on December 28, 2000 also includes "illegally intercepting and capturing, tampering with or deleting others' emails or other information, violating other's correspondence freedom and privacy" as criminal activities punishable with severe penalties.

Nevertheless, the law so far deals only with a few specific situations whereby individual privacy needs to be protected. The fact remains that there is no general privacy law or data protection law in China to date. The regulations passed by the administrative agencies are far from reaching the high-required standard of internet privacy protection. Furthermore, the right to privacy has not been enshrined as an independent right in civil law statutes, but embodied as part of the right to reputation. Therefore, it is quite necessary for China to learn from those countries and areas whose internet privacy protection have already achieved a high level, such as the United States and the European Union, and establish a comprehensive system of internet privacy protection.

6.2 Indication to China from Internet Privacy Protection of the United States and the European Union

As various countries specialize in their protection on the right to privacy and China has already been a member of the World Trade Organization, it is imperative for China to strengthen its protection on online privacy so as to realize a high level of domestic legislation. Several proposals are described below.

6.2.1 Clarifying the Status of the Right to Privacy in Civil Law

The right to privacy should be clarified as an independent right in the Constitution so as to provide legal foundation for internet privacy protection. In addition, the right to privacy should also be given a special status in the proposed Civil Code; otherwise, it should be clearly defined in the General Principles of Civil Law of the People's Republic of China.

6.2.2 Establishing a Comprehensive Protection System Adopting both Legislations and Self-regulations Approaches

Since the internet technologies of China are still in the initial development period, a better choice of internet privacy protection would be self-regulations formulated by relevant industries. The self-regulations govern network operators as the lowest legal standard. If the webmasters comply with these regulations, their responsibilities could be avoided. In the meanwhile, related laws and statutes should be promulgated to compromise the disadvantage of weak enforcement of industrial self-regulations. Unification of both self-regulations and legislations gives a dual benefit to network operators and internet users, thus, will promote the protection on individual privacy on the one hand and safeguard the development of information technology and social economy on the other hand.

6.2.3 Making an Independent Statute, namely, Internet Privacy Statute to give Protection on Online Data Information

This statute should include following aspects: 1) Rights to personal data information. These rights shall contain right of knowledge, right of revision, and right of disclosure, etc. 2) Collection and possession of data information. Without the consent of data subjects or their legal representatives, data information cannot be collected. Furthermore, legitimate measures should be taken into data information collection. 3) Use of data information. Only legitimate subjects can use data information in a certain scope. Users are not allowed to tamper others' personal data information. 4) Disclosure of data information. Lack of consent from data subjects, data information cannot be disclosed or revealed by any person. 5) Remedies against infringement. Data subjects could require injunctions or damages once invasion of internet privacy takes place by establishing a special data administrative agency to supervise data collection and use.

7. CONCLUSION

The development of the internet has dramatically enhanced our ability to acquire, process, send, and store the information. As a technological society, we cannot totally guarantee everyone's privacy. But imagine a world in which you had the right to obtain and confirm the accuracy of every piece of information being compiled about you, in which you had the right to correct, erase, or block any personal data that was incomplete or inaccurate, and in which companies were barred from selling data about you without your consent. That world effectively came into existence for the citizens of the United States and the European Union. With the effort to improve its data information protection, Chinese internet users will also embrace such a world in the near future.

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EXTENDING COLLABORATIVE TAGGING FOR USE WITH SCIENTIFIC DATA

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ABSTRACT

Collaborative tagging has proved a useful classification technique on the web. We describe the technique and its variants, what it means to ‘tag’ data and the benefits, under some circumstances, over more traditional classification systems. Scientific data sets have the necessary properties for tagging, but are often too complex to be categorised using a flat structure, and are generally organised using formal taxonomies or ontologies. We describe an extension and implementation to the collaborative tagging technique that enables an ad-hoc hierarchical classification structure to be generated in order to overcome this shortfall. We posit that using this technique alongside a formal ontology, information sharing between the structures will elicit a powerful but flexible classification system that can be used on sets of scientific data previously thought too complex for the tagging technique.

KEYWORDS

Collaborative Tagging, Hierarchical Tagging, Ontology, eScience, Web 2.0, Bioinformatics.

1. INTRODUCTION

Collaborative tagging has grown up as a data management technique within the Web 2.0 world, and has proved itself, albeit largely through anecdotal evidence, as a powerful tool to aid the organisation of data on the web. This can be seen in the popularity of sites that pioneered and now rely on the technique, such as *Delicious*, *Flickr*, and *Technorati*. The rapid growth of tagging due to its use on sites such as these has meant the debates surrounding it have been predominantly within the internet blogging community, and only recently has it seen a resurgence of interest in the academic literature. Academics and scientists have realised that they can harness the power of the technique within their own fields, where until now more traditional formal methods of classification have been entrenched. This increased attention has benefited collaborative tagging in two ways: existing implementations have been compared, analysed and improved [Broo06, Gold06, Macg06] and the sphere of data sets the technique is used upon has increased [Bate06].

The use of collaborative tagging on more complex data sets has highlighted two shortfalls with the technique: tagging only allows a *flat* classification structure to be created, and that ad-hoc classification is not useful for formal information. This means it is ill-suited to many scientific data sets, where an *ontology* – a formal structured representation of a set of concepts and relationships – is normally used. We explore these two problems and introduce our approach, an extension of collaborative tagging for use with complex data that does not sacrifice its key advantage of simplicity.

We begin with a review of collaborative tagging, looking at its place on the web and in the literature. We then discuss the issue of semantics, and the debate surrounding the choice between folksonomy and ontology and the use of tagging with eScience. Finally we look at existing extensions to tagging, and our own extension – hierarchical tagging – and its implementation.

2. BACKGROUND

Although collaborative tagging emerged on the web initially, there are a now selection of informative articles on the subject within the academic literature. Macgregor and McCulloch [Macg06] look at the most relevant

literature surrounding collaborative tagging, and discuss the main points in the debate of its use, in particular contrasting it with the more traditional method of using a controlled vocabulary. Voß [Voss07] also gives a good overview of the current research literature, as does [Marl06].

2.1 The Beginnings and Benefits of Collaborative Tagging

During the last decade, web content has made the transformation from being predominantly static to predominantly dynamically generated, and from being produced and controlled by individual content managers to being produced and managed by the community in which it resides [Orei05]. The sheer volume of data has grown dramatically and continues to grow [Coff98]. Existing data management techniques have grown up and novel techniques have emerged in order to keep up with these changes. Searching has become more prolific, site maps and the like have become ubiquitous, and websites have become dependent on back-end databases to store, manage and serve their content.

A traditional technique to aid data organisation is adding metadata in the form of *keywords*. This is generally done when creating the data, and the keywords are often chosen from a formal vocabulary. One of the most widespread and influential of the new techniques is tagging; applying informal keywords to data that act as metadata on the content, often *after* it is created [Macg06]. It is the informality of the tags, and the practice of applying after rather than during data creation, that differentiates tagging from traditional keyword systems. Collaborative tagging is a modified version of this technique, and has become particularly popular on the internet. *Many* users apply tags to shared content, resulting in an ad-hoc set of metadata that can aid content management, navigation, searching and filtering [Gold06]. The resulting collection of metadata has become known as a *folksonomy*; a taxonomic structure that is built by the community, rather than by a central or overarching body.

The practice of applying metadata to aid organisation is not novel (see [Rena97] for example), however the social aspect of allowing any of the users in the system to tag the same data increases the potential of the technique. Experiments using massive collaboration over a small team of experts have proved positive, for example the Wikipedia Encyclopaedia [Gile05], and the collective ‘wisdom of crowds’ has proved to be promising [Suro04]. If a central body adds metadata to content, we have a way to categorise it within a particular framework. If many distinct users add metadata, we gain information on how that entire set of users categorise data, and additional information about its popularity and relationships within the data set. The number of distinct users that tag a data item tells us of its popularity. The more frequently an item is tagged with the same keyword, the more we know about its classification within that field.

Several studies have been done to evaluate the usefulness of tagging as a categorisation tool, and have mostly been positive [Catt07, Gold06].

2.2 Tag Semantics

A tag is simply a free-text label; there is no controlled vocabulary being used as a basis. This is what some see as the main quality of tagging, opponents see this as an inherent flaw [Merh05]: the lack of a controlled vocabulary will result in a classification system of little use, or worse, no classification system at all. Before discussing this polemic and its antithesis, we should first look at the even more pressing point of semantics.

To tag is simply to associate between a keyword and a data item. The semantics of this association are poorly defined: what is the association between tag and data, and at what level of the data does the tag relate? There are therefore two aspects to this issue. Firstly there is the **function** of the tag: the information it conveys about the data. Secondly there is the **scope** of the tag: at what level the tag describes the data. Golder and Huberman [Gold06] identify a total of seven possible functions a tag may perform (examples in parentheses): identifying what the item is about (programming), identifying what the item is (*article*), ownership (*larrywall*), category refinement (*perl*), identifying qualities (*humorous*), self-reference (*mycomments*) and task organisation (*toread*). There is thankfully less scope when it comes to considering tag scope: it is either a description of the data itself or a description of the category into which it falls. Golder and Huberman find that the scope of the tag is less important; on the whole we naturally apply the properties of an encompassing term to the items classified within. The varying functionality of a tag however brings with it the possibility that not all tags are created equal: some clearly have a more *selfish* role for the creator, and are not as relevant to the wider community. In fact, Golder and Huberman's study shows that the majority of

tagging is done for personal use. These tags still turn out to be beneficial though, to individuals and to the community; tags such as *humorous* or *toread* are likely to be relevant to users other than the originator.

Even with such ambiguity inherent in tagging, both Golder and Huberman's study and the work of Cattuto et al. [Catt07] show that once there are sufficient users in a tagging system, their behaviour follows universal patterns such that a satisfactory classification system can emerge. In fact, Cattuto et al. find that the distribution of tags-to-posts follows a classic power-law behaviour, meaning that collaborative tagging follows the same model as many other human behaviours, such as word frequency distributions in corpora and citation distributions in academic papers.

2.3 Collaborative Tagging Versus Controlled Vocabulary

There is a strong debate about whether or not a collaborative tagging system could replace a more traditional controlled vocabulary system, which began within the blogging community before moving into the academic literature. We shall look at the main arguments and standpoints from within these two communities.

The views expressed can be categorised into three main camps: those strongly for tagging (and against controlled vocabularies), those strongly against tagging (and for controlled vocabularies), and those that believe the two may be able to coexist. A good starting point on the pro-tagging side is Clay Shirky's oft-quoted posting 'Ontology Is Overrated' [Shir05]. Perhaps written with the intention of sparking the debate to begin with, Shirky on the whole puts forward a good case for why tagging is a useful classification system and gives his opinion on why traditional classification systems can fail, using examples of fixed categories such as those found in the U.S. Library of Congresses, or the Dewey Decimal System. Providing us with a balanced antithesis, Peter Merholz gives an adequate rebuttal of these points in his follow-up posting 'Clay Shirky's Viewpoints are Overrated' [Merh05], but uses an unrealistic example of tagging that does not show off the system's real potential. Macgregor and McCulloch provide further analysis of these two views in [Macg06]. Merholz goes on to support the use of a folksonomy (or *ethno-classification* as he prefers to call it) as a starting point for a professionally constructed controlled vocabulary [Merh04]. Merholz has an issue with the neologism *folksonomy* and its derivation from *taxonomy* (hence the alternative term he uses), although we believe this to be unnecessary literalism on his part, especially as his replacement is equally misleading; tagging can be argued to be closer to a form of *categorisation* rather than *classification* [Math04]. *Categorisation* tends to be a looser, less rigorous process of arranging items according to some synthetic similarity, whereas *classification* is a much more systematic process of arrangement into well-defined groups [Jaco04]. Shirky perhaps also falls down in the same regard, beginning his article by defining the two words to mean virtually the same. By seeing the difference between them instead, it is clear that collaborative tagging and using a traditional taxonomy are actually two techniques to achieve two similar but distinct outcomes, and therefore we remove the need to disprove the effectiveness of one in order to prove the effectiveness of the other.

Those that view a third way, the potential coexistence of the two techniques, are much more numerous. Attempting to dispel the fact that there is perhaps any dichotomy here at all, Crawford [Craw06] believes there is no reason that one system should or will become universal, and even adds his own humorous line to the debate ('Dichotomy is Overrated'). Guy and Tonkin [GuTo06] argue that whilst tagging is not a replacement for conventional classification, it is the differences it has to these systems – the openness and 'sloppiness' of tagging – that make it so useful.

Williams [Will08] makes the interesting point that a relational database can be an excellent tool for storing *information* but something more flexible is needed for storing *knowledge*. It may follow that a system more flexible than a controlled vocabulary, excellent for *organising* information, could be useful for *organising* knowledge.

Macgregor and McCulloch [Macg06] identify the fact that there are problems in using a controlled vocabulary to describe very large existing data sets with little or no current metadata, and also data sets that are growing at a rate that limits the ability of a specialist team to curate. In these situations they see collaborative tagging as a viable alternative, or parallel system, for classification. They conclude that the two systems have their relevant roles, and a coexistence of the two will emerge, each being used within its relevant information context of *formal* or *informal*.

2.4 Tagging in eScience

It has been a slower process than one would imagine, but academics have inevitably joined the ranks of users using social bookmarking tools. The delay for academia to endorse these services is understandable, as the content has predominantly come from commercial sites, blog posts and personal opinions, largely neglecting the peer-reviewed literature. *CiteULike* and *Connotea* were the first major social bookmarking sites to emerge that were specifically catering for the academic community, and have since been joined by *Bibsonomy*, *2collab* and others. Some sites, such as *CiteULike*, originally allowed only papers from specific sites to be referenced [Hamm05], in order to perhaps gain the trust of the academic community. Most sites have now lifted such restrictions, but the focus remains much more towards the academic literature than other sites such as *Delicious*. Features such as tracking citation links between papers, and being able to extract metadata from paper publishing websites are what make these bookmark sites much more valuable to those users requiring access to the academic literature.

Perhaps more intriguing, *myExperiment* [DeRo08] from the *myGrid* project is a website that allows users to search for, upload and tag workflows, that can then be used on a workflow enactor engine such as *Taverna* [Oinn04]. Also, another promising attempt to include collaborative tagging into eLearning systems is presented by Bateman et al. [Bate06]. Their *CommonFolk* system allows users to create tags, but also allows the *relationship* to be defined by the user. We will look at this in more detail in section 0. At present, these two examples come from a very small set of systems that allow users to tag actual scientific data, rather than just papers or articles.

Within eScience, the field of bioinformatics is renowned for large, complex and often inconsistent data sets [McDe06]. It seems a logical step to see if collaborative tagging, having been successful on the web, and trialled in eScience projects, can be applied to more complex data sets such as those found in bioinformatics. Golder and Huberman stated collaborative tagging is most useful “when there is nobody in the ‘librarian’ role or there is simply too much content for a single authority to classify” [Gold06]. They say these traits are true of data on the web, and it is clear that they are also true of many data sets within bioinformatics. The two properties identified in [Macg06] that we discussed earlier that make using a controlled vocabulary difficult were when the data set is not only very large, but also growing rapidly. Emerging techniques within bioinformatics for generating and collecting data mean that the data sets are well described by these properties. Bioinformatics data sets also tend to span repositories and sites, be stored in a plethora of disparate formats, and frequently contain internal errors and ambiguities [McDe06]. These additional properties add further weight to the use of collaborative tagging as a potentially useful technique of data management in this area.

An ad-hoc classification system is thus well-suited to the types of data found in eScience. The remaining issue therefore, is that of whether the flat form of a folksonomy is a rich enough structure to usefully describe and annotate the complex data in these fields. In the next section we look at possible extensions to collaborative tagging that may enable a more complex classification to be developed.

3. EXTENDING COLLABORATIVE TAGGING

We have shown that a flat, ad-hoc classification structure (a folksonomy) can be built up by using the collaborative tagging technique. As more and more tags are added and the folksonomy grows, it may become apparent that the tags themselves can be categorised. Allowing the tags to be grouped together is therefore a logical step in this process, but it is important that this is done in such a way as to not break the simplicity of the collaborative tagging technique: the foremost reason for the success of collaborative tagging has been simplicity. A critical mass of users acting upon a particular data set is required to gain meaningful categorisation, and it is the simplicity for the user that facilitates this. If, for the user, the effort-to-reward ratio is too low, there is not enough incentive to participate in the classifying process. Collaborative tagging succeeds in this regard as the technique is simple to use and rewarding for the user, even without the collaborative aspect.

Whilst simplicity of use is key, there is evidence that some users find the depth of classification offered by tagging to be too simple, and wish to categorise their data more specifically than just using the single layer

of hierarchy in the metadata that tagging provides [Tonk06]. There are a number of ways to extend the categorisation possibilities, the three most common being compound tags, relational tagging and bundles.

3.1 Compound, Relational and Bundled Tagging

In live tagging environments, users have been found to extend the basic system provided themselves by creating compound terms in order to store additional categorisation information [GuTo06]. For example, tags such as *photography-nikon* and *photography-technique* are compounds of the common term *photography* and the specific tags *nikon* and *technique*. These compound tags are often concatenated – using underscores, periods, hyphens or camelCase (the majority of tagging systems use the space character as a delimiter between tags and so this is unavailable as a delimiter) – to retain human-readability. Unfortunately, this does compromise machine-readability. This practice is so widespread that research has been done to attempt to parse compound tags in an effort to extract the additional layers of categorisation that the users have added, with unfortunately limited results [GuTo06].

Relational tagging is an approach that enriches the categorisation by allowing the *relationships* between tags to be described. The implicit relation 'tagged' is overridden by a custom relation, for example 'authored'. This then distinguishes between different sets of tags, essentially creating a *faceted* classification model [YeSw03]. Although this approach may have potential, it adds complication for the user: there is an additional level of classification for the user to specify when creating a tag, and consistency is required when generating these tagging relations else the model can become unruly. One implementation of this, *CommonFolk*, uses a natural language ontology to guide the user in their choices of tag and relation, helping to keep the simplicity associated with the tagging approach. This alleviates the second of these issues, but still leaves the user with additional work to do each time a tag is created. Whilst in the role of curator this is not a real burden since the user is explicitly carrying out the task of applying metadata, if tagging is an additional action to be completed whilst carrying out a more general task, this extra work can be a major factor in whether or not the action is carried out at all.

Another approach is the *bundles* feature used by *Delicious*: it allows users to group tags together in bundles, or sets. For example, the tags *nikon* and *technique* could be bundled into a set called *photography*. Bundles succeed because the act of bundling is carried out independently of tagging: tagging remains a simple one-step process, and at their leisure the user can return to add order to their metadata. This feature was perhaps originally intended to simply aid organisation of large, unruly tag sets, but it is also interesting to realise it has effectively created an additional layer within the metadata hierarchy. Bundles however stop there, allowing only one additional layer of hierarchy to be created. Figure 1 summarises these techniques.

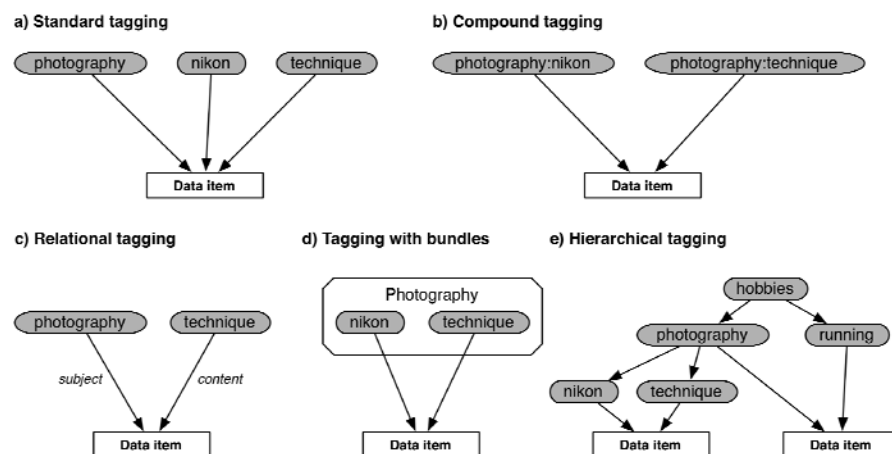


Figure 1. Extensions to collaborative tagging

4. HIERARCHICAL TAGGING

We propose hierarchical tagging as an extension to collaborative tagging, that allows a hierarchical categorisation to be created in an ad-hoc manner. Tag bundles effectively give the user one layer of hierarchy to group tags. Treating the bundle names as tags, rather than as a separate entity, the hierarchy can grow arbitrarily. Thus what can now build up is a hierarchical ad-hoc classification, rather than a flat one. This is the essence of hierarchical tagging.

As an example, the group tag *photography* could be tagged with *hobbies*, creating a total of three levels of hierarchy. As more tags are added to the system, additional layers of hierarchy can be added by the users when they see patterns emerging. Thus as well as the collection of tags expanding, the structure of relationships between those tags also expands, and unlike bundles, the user is not restricted to only using the leaf nodes to tag data items: all items within the structure are the same abstract type, a tag, and so all can be used as such. The process of creating this hierarchy can happen as a separate step to applying tags to new data, and so unlike relational tagging it does not introduce an extra level of work at this stage.

With hierarchical tagging we have overcome the second main drawback of most collaborative tagging systems, a lack of richness within the classification: the result is a structure closer to that of an ontology than to a simple controlled vocabulary. Earlier we saw that combining tagging and a controlled vocabulary in parallel may offer the most comprehensive solution. We will now go on to look at how a hierarchical tagging system may be used in conjunction with an ontology, and what benefits this may afford.

4.1 Combining Hierarchical Tagging and Ontology

Ontologies have become invaluable as tools to describe the information and knowledge held in a data set. By using terms from an ontology to annotate a data model – by data model we refer to a machine-readable data representation – we have the flexibility of a lightweight data structure but still retain the advantages of a thorough classification system [McDe06]. This method can be seen as a top-down approach; facts that are explicitly known about the data, starting generally and increasing in specificity, are applied to the model. This classification system tells us things we absolutely know to be true about our data, and can be used by our application to manage the data for us. On the whole annotations of this type, although not exclusively, will be created by an application rather than a user. Hierarchical tagging provides us with a compliment to this; a classification system with a bottom-up approach. Tags are applied to data items where the attribute to be described is perhaps vague, user-specific or not fully-formed in terms of its final goal or meaning. These tag annotations are added on-the-fly, and often changed, moved or deleted by the user (and in some cases by an application), and so have a different quality to them compared with ontological annotations.

The result of combining these two classification systems is this: in one direction a formal structure of permanent annotations, in the other a ‘scruffy’ structure of transient annotations. Both provide different and useful methods of classification; one applied predominantly but not exclusively by the application, one applied predominantly but not exclusively by the user. This combination not only gives us the benefits of both systems, but also allows us to let the two systems interact. If a term matures within the tagging folksonomy to a level where it can be applied consistently, it may be formalised by being added to the system ontology. This gives us a built-in mechanism for allowing the ontology to expand. Conversely, one might find a term from the ontology that does not apply completely accurately to a set of data items it is annotating. In this case a tag can be created and applied to an initial set of items annotated using the ontology, but then the necessary changes to the set could be made manually. This then allows the set to be represented but without breaking the semantics of the ontological term. In an area such as bioinformatics, where the data is inherently inconsistent and definitions differ between different sub-groups inside the field, flexibility is essential within a data classification system. Our approach of using both classification techniques in this way retains the flexibility of one and the formality of the other, modelling closely the properties of the data we wish to manage. From the top-down, a controlled vocabulary or curated ontology can provide a necessarily rigid and formal framework for the data. From the bottom-up, user-generated tags can classify data in areas where the controlled vocabulary or ontology has not reached or does not describe the data fully. Interaction between the two techniques may then be used to refine and strengthen both classification structures.

5. IMPLEMENTATION

Utopia (<http://utopia.cs.manchester.ac.uk>) is a proteomic data management and visualisation toolset created within the Advanced Interfaces Group at the School of Computer Science in Manchester, in part collaboration with the Faculty of Life Sciences [Pett02]. Version 1 of the Utopia suite uses a controlled vocabulary in order to classify and manage data. In version 1.4 we implemented collaborative tagging into our protein data search tool. This enabled us to see the shortfalls of standard tagging, but also to see the potential for its use in a scientific environment. Version 2 of the Utopia suite uses an ontological structure in order to classify and manage the data, and the user interface includes our first implementation of hierarchical tagging. Initial feedback has been promising and a full public release of Utopia Documents (the Utopia document viewer) will soon enable us to gather quantitative data on its use.

5.1 An Example

The following (with Figure 2) is an example of how hierarchical tagging could be used during research on a review article about Efflux Pumps in Bioinformatics using Utopia Documents, the document management tool within the Utopia suite.

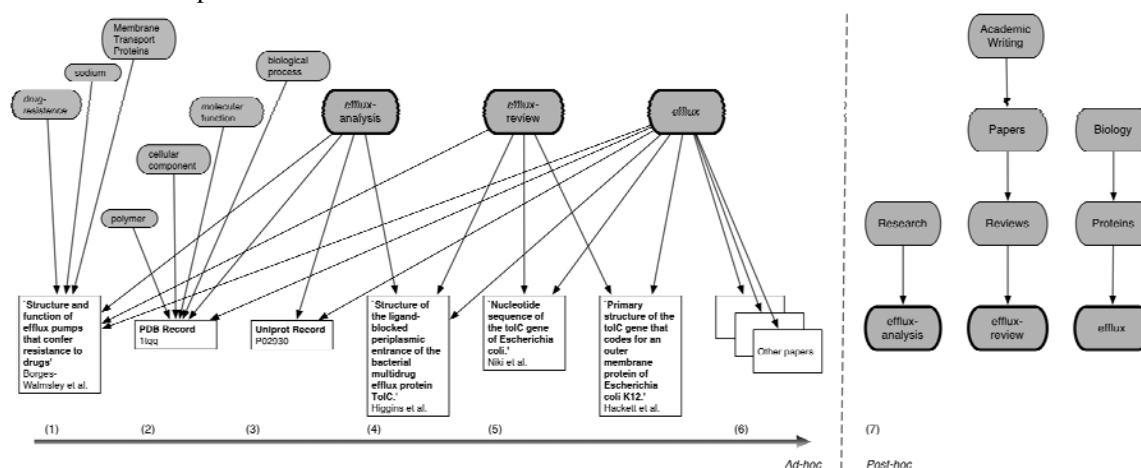


Figure 2. Tagging items ad-hoc, and organising tags post-hoc

An article by Borges-Warmlslet et al. is located on PubMed. The user downloads the article and tags it with *efflux* as it discusses efflux pumps, *efflux-review* as it is an article that relates to the review being written, and *efflux-analysis* as it talks about interesting biology that should be studied at a later stage (1). This article discusses a protein with the PDB identifier '1tqq', and so the user downloads this protein record from the Protein Data Bank and tags it *efflux* and *efflux-analysis* as it will be useful to carry out some research on (2). Both the article and the PDB record have additional keywords attached from their respective databases (shown to the left in the figure). These keywords are valid search candidates, and so are also stored alongside the tags. The PDB record cites an article by Higgins et al. and so the user downloads and tags this paper (3), and two prominent references from this as well; all useful for the review (4). A search of the UniProt Database using the PDB identifier returns a protein record and so this is downloaded and tagged; this may be useful for later analysis (5). Further references to related articles are found within this record, and whilst not immediately relevant to the review task at hand, they are downloaded and tagged with *efflux*, as they maybe prove interesting later on (6). After this task, three new tags have been created. This is the *ad-hoc* stage; tags have been created on the fly whilst carrying out other tasks, with a minimum of effort. The next stage, *post-hoc*, the user comes back to their tag collection and notices each of these tags can be added into their existing tag hierarchy (7). The user then has a more accurate and detailed classification structure, and a larger set of search terms that they can use to find their data. The implementation within Utopia Documents can be seen in Figure 3.

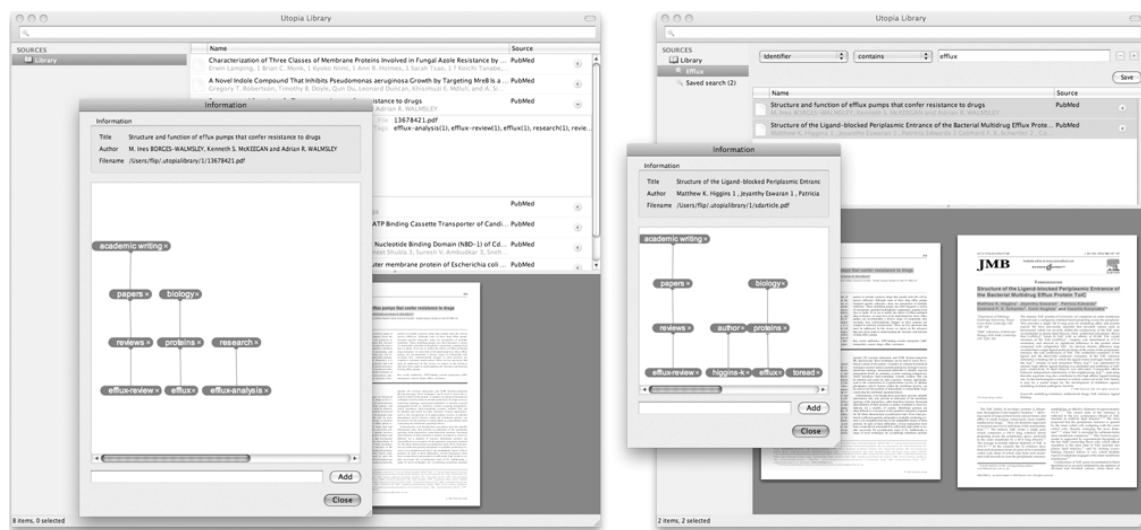


Figure 3. Hierarchical tagging in Utopia Documents

5.1.1 Future Work

Since ontologies allow multiple types of relations between concepts, it may be feasible to also employ the relational tagging technique, if it can be done in a way as to not override the simplicity of using tagging to begin with. The approach taken by Bateman et al. in [Bate06] appears to achieve this by the use of a guiding natural language ontology. We would prefer however to keep the initial work done by the user to the very minimum, and have the step of recasting relationships as a separate task to be performed at a different time to the initial metadata creation. The framework proposed however is an ideal starting point for such an approach to incorporating relational tagging in to a hierarchical tagging system.

6. CONCLUSION

Collaborative tagging has stood up to scrutiny as a classification technique and has a proven record amongst many data sets on the web. Scientific data is well suited in many ways, but standard tagging cannot comfortably model the sort of hierarchical classification structure needed. The hierarchical extension we have implemented addresses this shortcoming, without affecting the simplicity that is necessary for collaborative system to work. The co-employment of both a formal ontology and an informal hierarchical folksonomy delivers a data classification system that retains the power and flexibility of the two techniques, and the potential for further growth by allowing interaction and information sharing between them. Scientific data sets have been our initial focus since they are notoriously complex, and there is the need from the community to aid in their management. However, the technique is data agnostic, and so is ideally placed to be applied to a wide variety of data sets.

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ARTIFICIAL INTELLIGENCE AND GIS: USING A* AND A*TRAFFIC FOR FINDING DRIVING PATHS

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ABSTRACT

Driving directions Geographical Information Systems (GIS) are becoming some of the most used and needed systems by many kinds of users all over the world. A lot of examples of such application can be given: Yahoo maps, MapQuest, and Google Earth as examples of widely used online applications, mobile phone driving direction applications offered by mobile companies, vehicles GPS (global positioning system) and many others. Finding the best (or good) driving path between two addresses is subject to many factors where some of them could variables. Some of these factors are distances, road situation, road traffic, and others. This paper presents the problem and solution of finding a path between two points (addresses) in many aspects. It discusses spatial databases that are the main databases for all kinds of geographical information systems, presents currently used solutions and finally proposes an efficient solution that takes many factors into consideration using the A* (a known artificial intelligent algorithm) and A*Traffic (a variation of A*, proposed in this paper) as the main algorithms in the proposed solution.

KEYWORDS

Driving paths, GIS, Artificial Intelligence.

1. INTRODUCTION AND MOTIVATION

This section introduces the paper's main subject. First of all, spatial databases are presented as the main databases used in all Geographical Information Systems (GISs) including driving direction systems, also GISs are presented as widely used applications in many fields and finally driving direction systems and their importance are presented as the specific and main subject of this paper.

1.1 Spatial Databases

As most kinds of applications need databases, spatial databases are considered the main kind of databases used by Geographical Information Systems. Spatial (from space) databases are databases used to store information about geography like: geometries, positions, coordinates, and others. Also they include operations to be applied on such kinds of data like distance, area, perimeter, direction, overlap of geometries, and others.

1.2 Geographical Information Systems

“Geographic Information System (GIS) is a collection of computer hardware, software, and geographic data for capturing, managing, analyzing, and displaying all forms of geographically referenced information” [Halaoui, 2008].

Geographical Information Systems are being involved in most aspects of life and businesses. All GISs use spatial databases as their data warehouse that are manipulated and presented in a user interface. Later in this paper, driving direction example queries are given as examples of GIS applications.

1.3 Driving Path as a GIS Application

Finding the driving path is one of most asked queries in GIS applications. There are many factors that influence the criteria of finding the driving path; the following are the most important:

- Distance: What is the distance between the source and destination?
- Road situation: Is the road closed?
- Road traffic: how much traffic on the road?

2. RELATED WORK

An overview of practical and theoretical related work is presented in this section. An example queries are illustrated in the next part where the lower level (database level) of driving path applications is being presented in the second part. Finally, briefly present the existence of artificial intelligence in such applications.

2.1 Driving Direction Applications

This sub-section presents two of most widely used applications for finding driving directions: Google Earth and Yahoo maps. As a note, these two applications are not only used as driving directions application but also offer other GIS services which are out of the scope of this paper.

2.1.1 Google Earth

Google Earth [Halaoui, 2008, Google Earth, 2008] is a geographical system that offers the user satellite images of the locations along with spatial information (coordinates, elevation, etc.). It contains about 70.5 TB of Data (Google Earth Blog, 2006). It provides the user with three main kinds of data: Raster data, Spatial, Non-spatial data, and Video.

Moreover, “Google Earth” offers a set of functionalities, and here is an important subset of them:

- Answer location queries: the user gives a location (New York, USA) as an input and gets a geographical image as an output. The image can explored in details
 - i. This feature includes: cities, businesses, public places (museums, etc) and others.
- Show directions: the user gives a source and destination as inputs and gets a map (output) showing the directions with driving hints written on the map.
- Displays spatial information: Google earth shows spatial information like coordinates, elevations, altitude, and others.
- Has learning abilities: Google earth saves recently and regularly visited locations and queries so that the user avoids delays the next time these locations or queries asked.
- Include pre-known locations: Google earth offers a list of most used locations like government offices, schools and others.
- Provides user interaction: the user is able to put place marks on the maps so can avoid delays the next time visits the same place.
- A prepaid online service that provides the customer with live video (with restriction and delay due to security) of any place in the world.
- Other products like Google Earth PRO: it is a paid service that makes it very easy to research locations and present discoveries. In just a few clicks, the user can import site plans, property lists or client sites and share the view with his/her client or colleague. Moreover, the user can export high-quality images to documents or the web.

In addition to introducing Google Earth, this section presents a driving directions query as an example of the driving direction services that Google Earth offers, which is directly related to the work in this paper.

Driving Direction Query by Google Earth: Form “New York, NY” to “Jersey City, NJ”

Figure 1 shows the driving direction with a map image from New York, NY to Jersey City, NJ. The figure shows the inputs (source and destination) and outputs on the map (Roads and driving direction). In such

queries, “Google Earth” provides the user with some driving tips to be followed when driving from the source to destination given in the query in question. The user can be more specific by passing a full address (building, street, city, state, and zip assuming U.S.A. is the country). Note that tips and arrows drawn outside the figure are offered by Google Earth but added in this paper for better understanding.

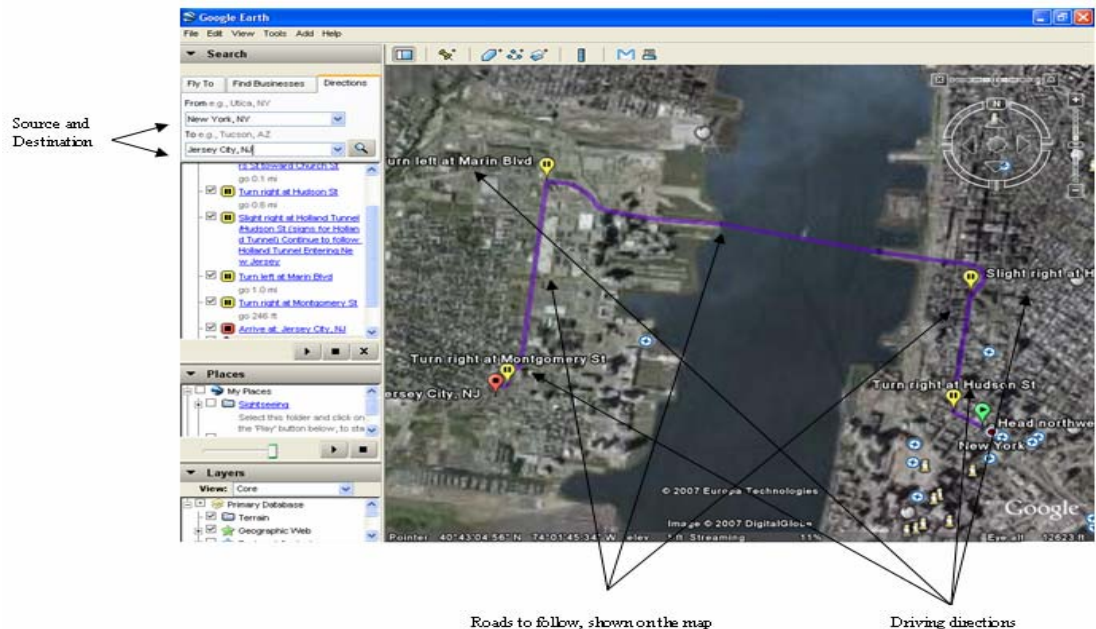


Figure 1. Road and driving directions between New York, NY and Jersey City, NJ

2.1.2 Yahoo! Maps

Yahoo! Maps [Yahoo Maps, 2008] is a free online application offered by Yahoo web site. Yahoo! Maps offers a lot of services like locating addresses, finding driving directions and other maps services within United States and Canada. In this section, only an example of the driving direction services will be presented since it is directly related to the paper's topics.

Driving Direction Query by Yahoo! Maps

Figure 2 the shows the path (in purple) that the user may follow to move from address A to address B (specified in the figure). The service includes providing distances, time estimation and driving tips. A shown in the figure it offer and clear map that can be zoomed out and in for better view. The tips (in blue) shown outside the map with the yellow arrows are not part of the display by Yahoo! Maps but added for better view of the figure.

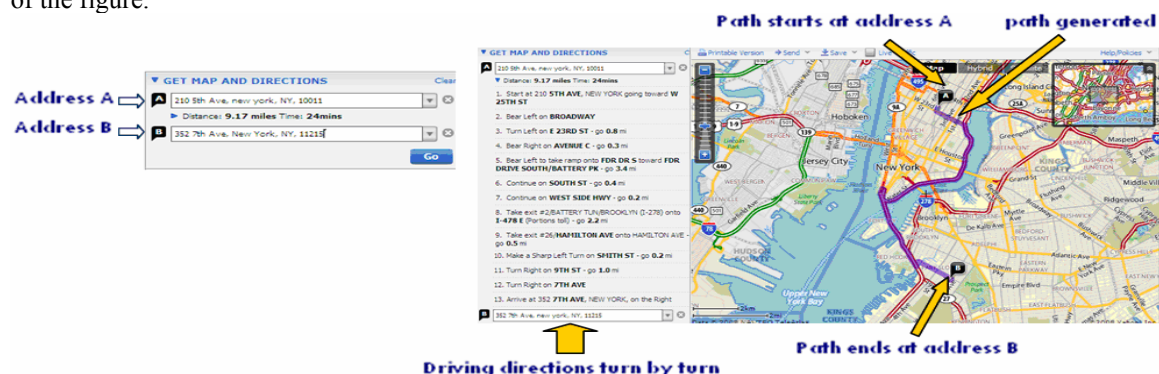


Figure 2. Road and driving directions between addresses A and B

2.2 Artificial Intelligence and Driving Directions

Artificial intelligence is involved in graph searching algorithms. Russel and Norving [Russel and Norving, 2003] present many intelligent graph searching algorithms. Here are two important ones:

1. Greedy best-first search
2. A* search

The main idea behind these algorithms is that they do not try all possible cases to give an answer. On the other hand, the algorithms use heuristic function to un-check some of the paths. This issue save huge amount of time but does not guarantee a best path. However, finding a good heuristic function could guarantee up to 95% finding the best path. Section 3 include the A* search algorithm which clear the idea in this section

3. PROPOSAL: DESIGN, ALGORITHMS AND IMPLEMENTATION FOR A DRIVING DIRECTION SYSTEM

This section present the database design, application algorithms, and the application of the intelligent driving path application claimed in this paper. Examples of executions demonstrated using our testing tool, are presented.

3.1 The Database for the Testing Tool

This section briefly present the database design, tables and relationships between tables used in our testing tool. Figure 3 present all the kinds of data (tables) used in the testing tool application. The database include information about various kinds of data (streets and buildings that also could include hospitals, Hotels, Banks, and Supermarkets) where each include spatial data (locations represented by points for building and lines for streets). Some other tables like point and edge are used to build our graph data structure that will be used in the testing tool's main algorithm (A* and A* traffic).

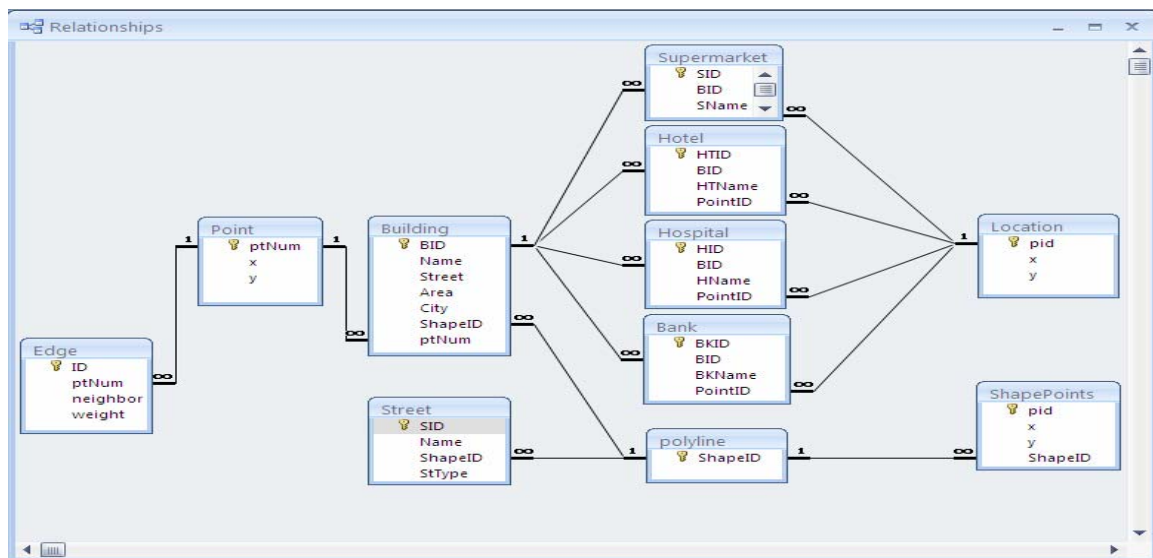


Figure 3. Testing tool database tables relationships

3.2 A*: An Artificial Inelegant Algorithm for finding Driving Directions

A* [Pearl, 1983, 1984, Russel and Norving, 2003] is an Artificial Intelligent graph algorithm proposed by. The main goal of A* is to find a cheap cost graph path between two nodes in a graph using a heuristic function. The main goal of the heuristic function is to minimize the selection list at each step according to a

logical and applicable criterion. In the graph example, finding the shortest path from a node to another has to be done by getting all possible paths and choosing the best. This process is very expensive and time consuming when having a huge number of nodes. On the other hand, using an evaluation function (heuristic function) to minimize our choices according to intelligent and practical criterion would be much faster especially for applications that users have seconds to get out put as the driving direction application. The heuristic function is not a constant static function. It is defined according to the problem in hand and passed to the A* as a parameter.

In the case of A* search for a direction path, the heuristic function F is built up from two main factors:

H = Straight Line distance to destination (distance between two coordinates).

G = Distance Traveled so far.

$F = H + G$.

At each node n, we compute F (n) and we choose our next step accordingly (the node with the least value is of F chosen).

3.2.1 A* Algorithm

A*(Source, Destination, F)

Define a List L that includes all visited nodes n_i with their values of $F(n_i)$

Define the Stack S that includes nodes n_i with their values $F(n_i)$

1. Start at source (source is the starting point)
2. Mark the source as visited
3. Push source in the stack S
4. Add source and $F(\text{source})$ to L
5. Get top element TE of the Stack S
6. For each unmarked neighbor UN_i of TE add UN_i and $F(UN_i)$ to L
7. From L choose N: the node with the least $F(N)$ then pop all elements in S until predecessor of N appear on top.
8. Push N in the stack S
9. Go back to step 5 until the destination node appears or no more unmarked nodes.
10. If no more unmarked nodes Return No Solution otherwise Stack as a solution

Note that A* Algorithm is a polynomial time algorithm with time complexity in $O(n^2)$ in the worst case and $O(n \cdot \log n)$ in the average and best cases.

Figure 4 is an example of the A* algorithm behavior to find a path starting from “Arad” “Bucharest city” in Romania [Russel and Norving, 2003]. First of all we start at Arad and go to the next neighbor with the best heuristic function (Sibiu). Second, explore all neighbour of Sibiu for the est heuristic function (evaluation of the function is shown). The algorithm continues choosing the best next step (with the least value of heuristic function) until it reaches Bucharest.

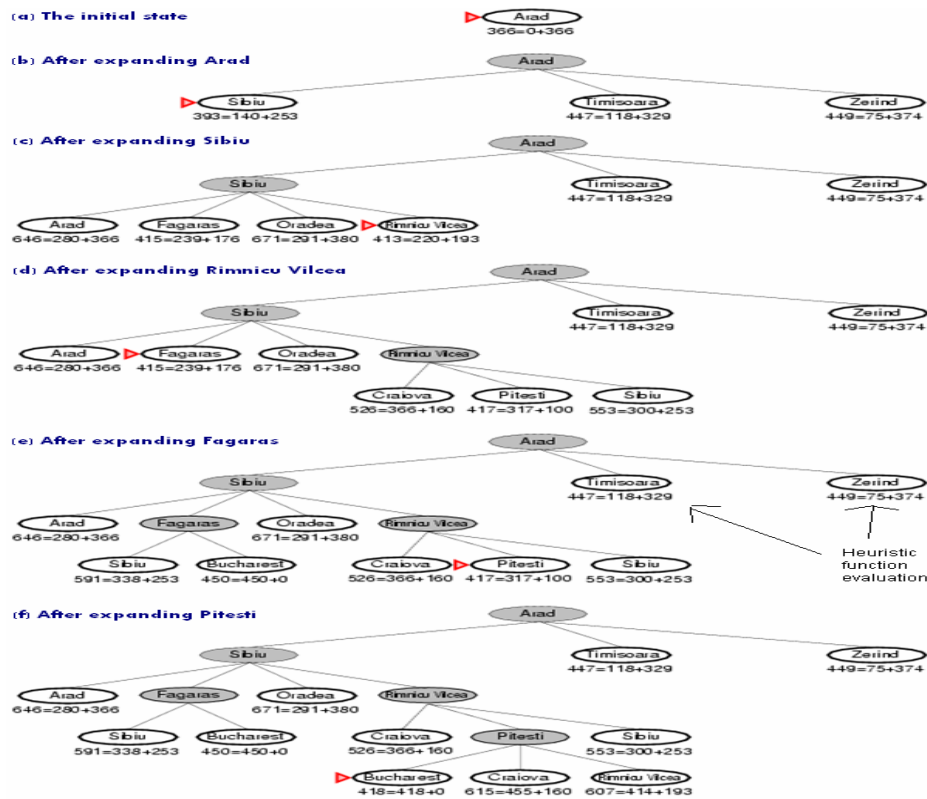


Figure 4. A* algorithm behavior to find a path starting from “Arad” “Bucharest city”

3.3 A*Traffic: A Variation of A* with Road Traffic as a Factor

This section presents our extension of A* called A*Traffic. A*Traffic could be seen as a variation of A* with the ability to take traffic into consideration when computing the driving direction solution.

The main job is done in the heuristic function where a new factor is used to choose the next step. The new factor is the average traffic value (got online from real time databases) represented in the following form time/distance (example: 3 min/km).

The new Heuristic function will be:

$$F = H + G + T$$

Where:

H = Straight Line distance to destination (distance between two coordinates).

G = Distance Traveled so far.

T = Average Traffic delay

3.4 Testing Tool: Query Example

This sub-section presents the layout of the testing tool developed to test our algorithm proposal “A*Traffic”. For this purpose, an example query is presented.

Query example: from “HU, Kantari St, Hamra” to “AUB, Bliss St, Hamra” (Beirut, Lebanon)

This example demonstrates the main feature of the software. It provides the user with the driving directions between “HU, Kantari St, Hamra” (Haigazian University) and “AUB, Bliss St, Hamra” (American University in Beirut) in Beirut, Lebanon. In order to find the driving directions the user has to type a start address and a destination address and clicks on the “Go!” button. Once the button is clicked the software generates a path

(in blue) between the start and the destination addresses. The blue path generated is a short path (using A*Taffic) to follow in order to drive from the start address to the destination address. Figure 5 illustrates this example.



Figure 5. Path from “HU, Kantari St, Hamra” to “AUB, Bliss St, Hamra”

Note that the traffic information is being entered by administrators directly to the database. In other words, the user does not pass this information.

4. ANALYSIS AND RESULTS

In brief, using A* algorithm saves a lot of execution time when finding the path. In an optimal algorithm all possible paths has to be found and the shortest is selected among them. Such an optimal algorithm is not in P (class of polynomial time algorithms) which could take years to solve in some cases. In our case, A* and A* traffic are in P (. They guarantee finding a good solution but do not guarantee an optimal solution.

However, our analysis showed that our solution is an optimal one in 88% of the times and 97% for short driving paths. The reason for such good results is that the A* algorithm takes a lot of path related issues into consideration.

The following table (Table 1) represents the results gathered from applying 100 executions in each case (long, average, and short) where:

Optimal solution: Best solution

Good solution: takes maximum of 30% more time than optimal solution

Bad solution: Takes more than 30% more time than optimal solution

Table 1. Percentages of quality of solutions over different cases

Distances	Optimal solution	Good Solution	Bad Solution
Long distances (>300km)	76.4 %	14.2%	9.4%
Average Distances (between 100km and 300km)	90.5%	7.2%	2.3%
Short Distances (<100km)	97.2%	2%	<1%
Average	88%		

5. CONCLUSION AND FUTURE WORK

This paper presents an artificial intelligent algorithm and proposes a variation of this algorithm. The purpose of the algorithm and its variation is to be used in a GIS application for finding and presenting the driving

paths between two points. The main point behind using such algorithms is find quickly and efficiently a good user solution for driving path. The algorithm guarantees a good and sometimes but not always the best solution since finding the best solution requires finding all possible solutions and choosing the best, which is very time consuming (time complexity in $O(n!)$).

In the future, we plan to make more tests on different cities with different characteristics (example: more one way roads). Moreover, there are other issues that could be taken into consideration like receiving satellite data (traffic, road cut, others)

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DEVELOPING TOPIC MAPS APPLICATIONS LESSONS LEARNED FROM A DIGITAL LIBRARY PROJECT

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ABSTRACT

The development of applications based on semantic information is generally bound to a wide variety of challenges, e.g. choice of meta-model, workflow, visualization, editing etc. This paper will summarize our experiences in developing Topic Maps based applications within a Digital Library project in order to present a set of lessons learned for developers in a broad range of application domains. The presented lessons learned gathered from a real life project can also be beneficial for education in particular for software engineering lessons in the special field of ontology based software development.

KEYWORDS

Digital Library, Topic Maps, Ontology, Software Development

1. INTRODUCTION

The potential of Topic Maps [1] in representing, exchanging, gathering and merging of information is well accepted in the knowledge representation community [2, 3]. Most of the Topic Maps applications are situated in the field of knowledge representation and – organization [4, 5, 6, 7, 8] to visualize and structure complex knowledge areas, to enhance information retrieval processes or to serve as an integration meta-layer between several representations of concepts. None the less in many application domains researchers have to solve a set of similar questions, like: which meta model shall I use for the formal modeling of the relevant domain knowledge, how do I communicate the several topic map drafts effectively, is a roadmap available for supporting the development process and what are the key advantages of using Topic Maps.

This paper will summarize our experiences in the development of Topic Maps based applications within a Digital Library project [9, 10]. A lot of these down-to-earth problems had to be solved in various domains, so we will present a set of lessons learned, which we hope will be quite useful for software engineers and researchers in other kind of application domains, which had to deal with ontology development and -application.

2. LESSONS LEARNED

2.1 Lesson One – Workflow

The central idea is to use domain knowledge for the support of information retrieval and navigation [11]. The key challenge is to identify and formal model the relevant aspects of the knowledge domain, which is generally a complex and time-consuming process [12, 13]. Especially, in the early modeling phases a comprehensive and detailed understanding of the domain is mostly missing. Due to this, modeling is always an iterative process, where earlier decisions have to be constantly revisited and modified [13].

To cope with this complex process we adapted a generic workflow for the ontology modeling [12] with Topic Maps (see fig. 1). Beside the individual processing steps (e.g. domain analysis, meta-model design, etc.) the necessary organizational framework as well as the involved actors are described in detail. Such a workflow helps to structure and organize the knowledge modeling process in an efficient way and can provide the ontology engineers with helpful guidelines and recommendations, e.g. modeling alternatives for specific purposes [12].

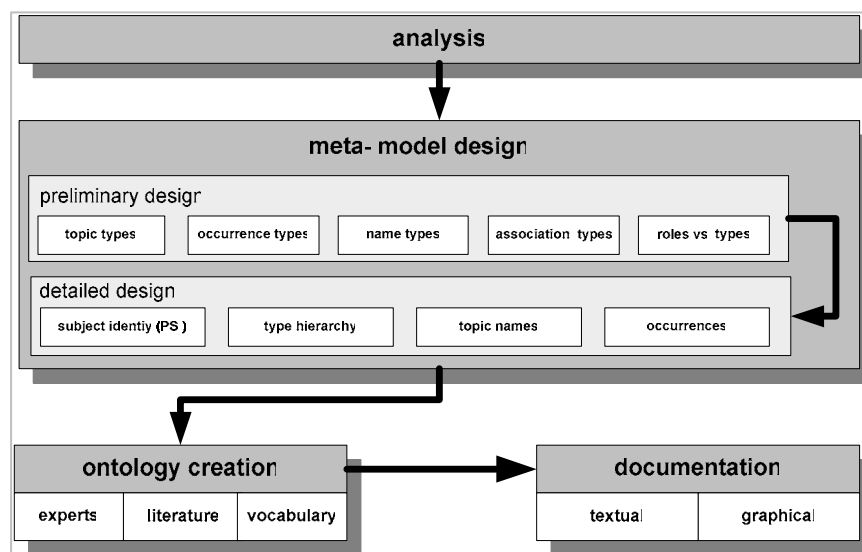


Figure 1. Workflow for Topic Maps

Summarizing from our practical experience we learned that it is inevitable to use a structured workflow in order to deal with the complexity of the knowledge domain and to provide a suitable level of quality. It became also clear that identification and modeling of relevant knowledge can never be finally completed. The different views of authors and doctrines as well as the continuing evolution of the knowledge domain demand a continuous extension, revision and maintenance of the model and application [11, 12].

2.2 Lesson Two – Modeling

Based on a detailed analysis of the knowledge domain the first step for the actual modeling is the development of a meta-model, which defines how the identified relevant knowledge is modeled in the Topic Maps structure [13].

According to the Topic Maps paradigm every relevant subject is represented as an individual topic node [11]. Similar to the semiotic triangle where concepts are separated from expression in our meta-model all known descriptive terms (depending on context like time, language, doctrine) are added as topic names [14, 15]. Relevant relations (e.g. part-of, class-sub-class) are modeled as associations [14]. Based on our experience an adequate representation of different doctrines and author specific views requires a context based, multi hierarchical approach, which is demonstrated in fig. 2 for the topic “gear” using the GTMalpha notation [16].

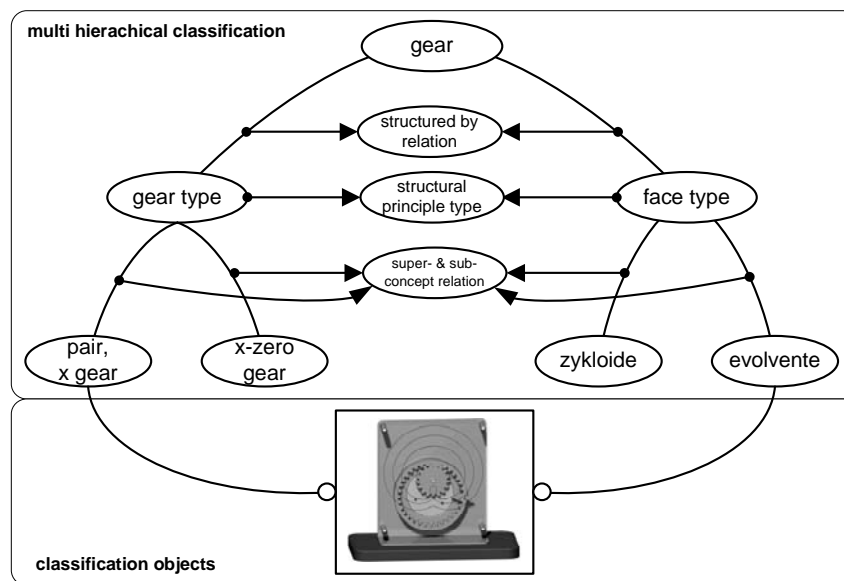


Figure 2. Exemplary usage of the metamodel

Summarizing the meta-model is the foundation of the final topic map, which shows and explicit documents which specific structure and types are used to model the domain knowledge. Without a proper meta-model and a suitable documentation a long term usage and maintenance of the modeled knowledge is not possible, because there are a lot of different suitable ways to model a relevant aspects and therefore consistent and detailed modeling recommendations are highly necessary [12, 14].

2.3 Lesson Three – Notation

In the modeling process of a topic map many different actors are involved, e.g. knowledge engineers, domain experts as well as users [12, 14]. For the support of discussions and the documentation of the used ontology meta-model a graphical representation of the topic map draft can be quite helpful [17]. Using a standardization graphical notation for Topic Maps (GTM) ensures that involved knowledge engineers are able to interpret a topic map graphic correctly and uniformly, which is especially necessary for a collaborative modeling process [13].

In the last years several drafts for a GTM have been published [17, 18, 19], but till today no graphical notation is general accepted and used in the community, which is quite odd, regarding the acknowledged necessity of a graphical notation as a communication and modeling device. Analyzing the existing GTM drafts, we have observed that there is a clear trend to reuse and adapt existing graphical notations from the field of data and knowledge modeling [13]. Based on an evaluation [13, 16] we have gathered strong evidence, which indicates that none of these notations (e.g. frames, concept maps, UML, ERM) could be used for a graphical representation of Topic Maps without adjustments or extensions. However, reusing an existing graphical notation in a different manor as original intended, forces the user to relearn the notation elements and rules as well as increases the risk of misinterpretations considerably [13]. We concluded that the creation of a conceptual new graphic notation for Topic Map is inevitable.

To address this problem we developed GTMalpha [16], which considers general requirements for modeling [13, 20] and the specific characteristics of the Topic Maps paradigm [1]. It allows a complete and consistent graphical representation of any given topic map draft according to the TMDM [1]. GTMalpha provides two special views which highlight either the network of relationships or the subject centric knowledge on a selected subject [16]. The amount of effort to learn and to use the notion is moderate, because only simple shapes as well as only few notation rules have to be considered. Fig. 3 shows a GTMalpha [16] representation of the displayed topic map draft.

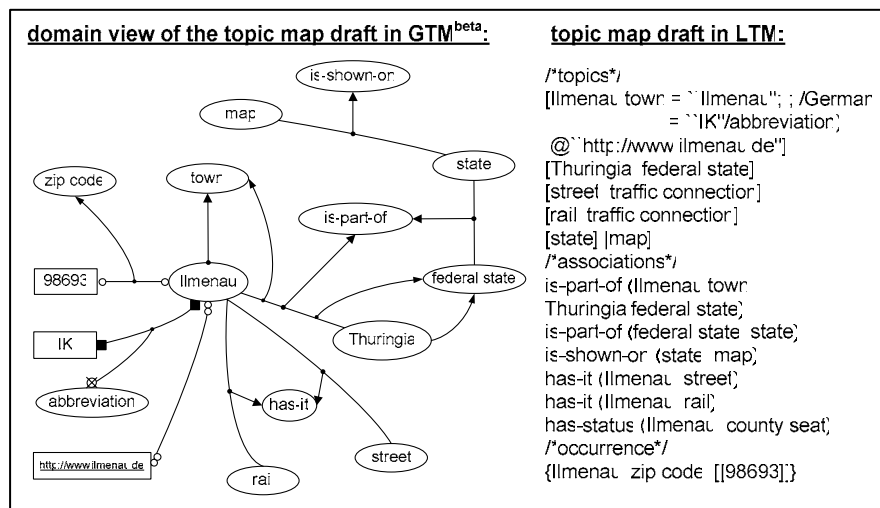


Figure 3. GTMalpha vs. LTM-textual notation

Summarizing the key essence of lesson three is that a standardized graphical notation is highly important for the collaborative development and especially for the documentation of ontologies. With GTMalpha [13] we addressed this problem by providing the first usable graphical notation for Topic Maps. GTMalpha can serve as a starting point for the creation process of an official GTM standard [21].

2.4 Lesson Four – Editing

Editing in terms of creating the meta-model as well as importing and maintaining the knowledge instances is another challenging task in this context. The need of applicable and free editing tools for Topic Maps is still unsupplied [14, 22]. An editing tool must support collaborative ontology modeling and basic search capabilities. Another common problem is Unicode support, which is a requirement to model names in multiple languages and for special purposes as defined in the TMDM [1], e.g. Russian, French or some kind of chemical notation. Additionally the tool has to support scoping of ontology concepts to support the multi-hierarchical structure of the knowledge domain as proposed by the meta-model (see section 2.2).

The editing process is divided into two parts:

1. Encode the identified concepts into a topic map according to the chosen meta-model. Concepts, names and associations as well as already existing thesauri, glossaries and classifications are helpful for this task [12, 14].
2. Link the concepts with addressable relevant information resources. An already existing information retrieval system or data base management application is also helpful for this task [22].

We developed a sophisticated toolset to support these two steps. The first tool is a Topic Map Editor (tmedit.org) with Unicode support and fully compatible to TMDM [1]. The editor integrates sophisticated search capabilities (search for instances and multiple languages) and the capability to encode language variants and dynamic association creation. The whole tool is designed according to the Model-View-Control (MVC) paradigm and thereby easy to customize for any kind of application domain. Figure 4 shows a screenshot of tmedit for the topic “Yoke Cam” with name variants in multiple languages and a corresponding French synonym “Excentrique” [9].

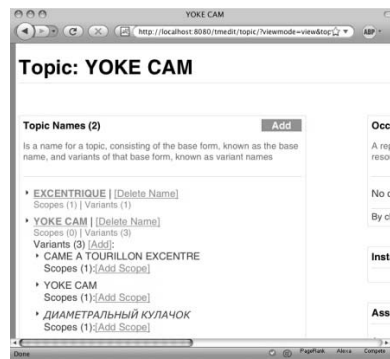


Figure 4. tmedit screenshot showing the topic Yoke Cam

To use the topic map as a semantic meta-layer for the support of information retrieval it is necessary to link the abstract concepts with relevant information resources as mentioned in step two of the editing process [12]. Therefore we developed a second tool that uses the already implemented high-performance, full-text based search engine of tmedit. The application provides the following three modes. The automatic mode searches for every given name (basic identifier and name variants) for a concept and link them automatically to the according concepts. This is a very fast term-based method but with uncertain quality [14, 15]. The second mode (semi-automatic) generates a list with suggestions using the same idea and the possibility for an expert to confirm the results. Using this method the quality of the linked information resources can be improved. The last mode (manual) provides a free text search capability with manual confirmation of the retrieved results. By using this method an expert can also add information that is not described by a common term in the search index (unknown item search) [14, 15]. This requires intellectual efforts and leads to a high quality semantic meta-layer.

Figure 5 shows the interface for free-text-searching. An expert can use the metadata or uncommon term combinations to retrieve information resource suggestions. After that the suggestion can be linked to any topic in the topic map.

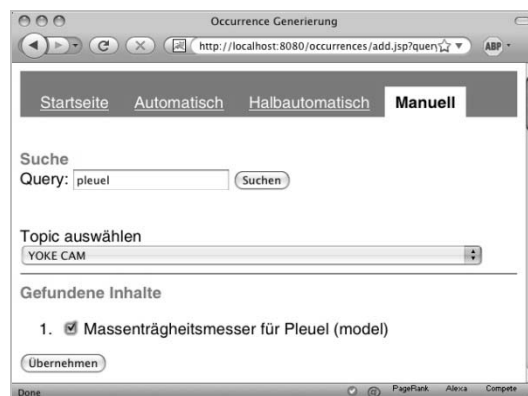


Figure 5. Free text search capability with export confirmation

To sum up to support the editing-process a sophisticated toolset is required. The tools must support the ontology editing as well as the linking process. Only a topic map with linked information resources (occurrences) can be used as a flexible semantic meta-layer for information systems. The application and integration of the resulting topic map is described in "Lesson Six".

2.5 Lesson Five – Visualization

Another challenging task for a Digital Library is to provide an intuitive, easy to use and flexible access to the modeled knowledge of the domain [12, 14, 23]. A graphical visualization of the relevant concepts, their relations and the amount of corresponding subject relevant resources can be a helpful supplement for the information retrieval [13, 19, 24]. However, a topic map containing these semantic information, tend to be

complex and extensive [1]. To support navigation and retrieval it is obviously not very helpful to visualize it completely [13, 24]. A common solution is a subject centered approach, whereby for a selected node all associated concepts are displayed in an automated generated graph [19, 23, 24]. Such visualizations can be created easily and fast for any topic map. Despite this clear advantage, this approach possesses three major drawbacks. Every time a user selects a new topic node, a different graph has to be generated [23]. This results in constantly changing visualizations, which is quite confusing for the user because he cannot establish a mental model of the information structure [24]. Information on the structure of the semantic information, in terms of the big picture, is difficult to obtain. The generated graph for a whole semantic network is from the perspective of the algorithm optima but from the perspective of the user mostly chaotic and difficult to understand due to the ignorance of the meaning of the semantic information [24].

The resulting visualization emerges direct from the topic maps and therefore is only based on modeling decisions of the knowledge engineer [12]. However, if Topic Maps are used to support retrieval and navigation, the interpretation of the users can be more important. Based on their individual needs and capabilities only a specific fragment of the semantic network as well as quite different graphical mappings can be appropriate like a hierarchical tree, a list or a network [17, 24]. Consequently the visualization should depend on the focused task of the user e. g. highlight structure or provide detailed information.

Concluding instead of an automated generated visualization, multiple problem oriented views are needed, which focuses on the individual requirements of the user and the specific retrieval task rather than a generic visualization of the semantic information. This approach can help to simplify the retrieval and prevent the user to be overwhelmed by the huge amount of other semantic information. To create such problem-oriented views a human interaction is inevitable. Only a human editor is able to interpret a specific problem and process the modeled semantic information in a way to support information retrieval and navigation [15, 24]. Such an intelligent design approach shifts the focus from the automated generation to the design process where manually visualization information are added, e.g. selecting of important nodes, specification of the node arrangements as well as the highlighting of important aspects [24]. To address this problem we developed the tool set TMchartis as a prototype for the creation of multiple problem oriented Topic Maps visualizations (see fig. 6).

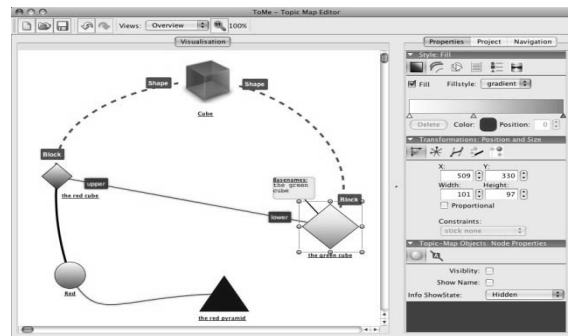


Figure 6. TMchartis based visualization

Summarizing the key essence of lesson four is that the complex and problem specific navigation and retrieval problems require the combination of automated layout and intellectual design to provide the user with helpful graphical visualization based on semantic information.

2.6 Lesson Six – Integration

The Topic Maps technology offers a lot of opportunities for integration and application [1, 11, 14]. However, there are only handful real world applications done so far. For a seamless integration in an existing information system we need the capability to infer from the information resources to the concepts encoded in the topic map and vice versa [22]. Knowing the according concept of every information resource allows us to increase the user-experience by showing related information modeled in the topic map.

Figure 7 (left) shows additional semantic information integrated into the information portal of the Digital Library. On the right hand the class of the current gear model is shown, as well as the according names in French, Russian and English [9]. Below that box other relevant information resources belonging to this model, resp. to this class is shown. This semantic information is applicable all over the portal. It can also be

used to enhance the search results by showing the classes and additional names as well as using the variant names for searching as already described in lesson 3. In addition the topic map with the linked information resources can be used to generate aggregated views on concepts and all available information. Figure 7 (right) shows an aggregated view of the topic “Kurvengetriebe” [9]. All language variants, super classes, related subclasses of the according super class and linked information resources are displayed.

Furthermore the semantic information in the topic map can be combined with existing information spaces and services [14, 24]. For example we have developed a prototype which displays dynamically the geographical and chronological context of a given topic name based publications (books, articles etc.) in the DMG-Lib [9] project via Google Maps. Creating a topic map for real world applications is just the first step. Only if the semantic information are seamlessly integrated into the information system the user-experience can be increased.

As a result a matching on sides, the semantic meta-layer as well as the information system, is needed. Our methods and ideas are just first steps and a lot of more scenarios are feasible.



Figure 7. Portal Integration

3. CONCLUSION AND FUTURE WORK

This paper gives a review of our experiences gathered from the development of a Topic Maps based Digital Library application. The presented lessons learned are exemplary solutions for common problems in a large variety of Topic Maps based applications. A structured workflow can help to control the time consuming iterative modeling process. A meta-model is necessary to avoid misinterpretations of the topic map and to support the documentation within a collaborative development based on a standardized graphical notation. A powerful toolset (editor, visualizer) is necessary for an effective construction phase of the topic map. And finally the seamless integration of the topic map into the Digital Library application is a basic requirement to enhance the information retrieval process.

From our point of view in a next step the set of developed tools should be glued together into an open source toolset for the development of Topic Maps based applications. The lessons learned are not only suitable for topic map applications; a lot of the mentioned problems are also applicable for any ontology based implementation.

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USING DATA-PUSH FOR THE DESIGN OF A PERSONALIZED FOREST FIRE EVACUATION GRID SERVICE

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ABSTRACT

Effective and efficient forest fire evacuation services often require data integration from heterogeneous and distributed sources. When such situations occur, gathering as many relevant as timely data is particularly critical. Recent forest fires occurred in Southern Europe including Portugal, France, Italy and Greece caused environmental destruction and a number of fatalities. Apart from the fact that people require receiving regular training and consequently maturely responding to the orders provided by relevant emergency co-ordination units and their rescue services, most fatalities occurred because victims have been surrounded from the raging fire and were not aware of available evacuation routes. Evidently, forest fires will occur if drought and consecutive heat waves during summer periods will continue and be considered as one of the causes for their occurrence. These are in turn suggesting the need for further work in the area of advanced evacuation systems when a forest fire is in progress. Therefore, we are particularly interested with a notable practicality, namely how potential victims can be kept automatically informed of the most relevant evacuation routes in the most timely fashion so they can escape safely from a forest fire in progress. On the other hand, it is of critical importance for disaster managers keeping automatically informed of fresh changes – occurred at various distributed sources – of their direct interest, which will influence their decisions in the most positive way and thus, produce, issue and push relevant available evacuation routes to people of an affected area in the most timely manner. With this in mind, we go on to describe in detail the design and architecture for a relevant forest fire evacuation service using a matchmaking data push technique, wireless communications and grid technologies.

KEYWORDS

Sustainable society, Grid technologies, Disaster management, Distributed data integration, Data push,.

1. INTRODUCTION

Much work is under way within the disaster management community on both organizational and technical issues towards the identification, prevention and reduction of disasters caused by the occurrence of extreme natural phenomena. Among others the increase number of forest fires is considered a threat and of great risk to people, property and the environment and it causes disastrous results. Recent forest fires occurred in Southern Europe caused serious environmental destruction and a number of fatalities. In such cases, emergency response is very important and the effective and efficient management of response operations requires a number of information and communication technologies (ICT) and relevant collaborative computer-based systems to assist and bring together the intellectual and physical resources of different authorities and the sharing of accurate information in a timely manner. However, several obstacles arise in the design and implementation of such services.

On the other hand, forest fire potential victims often lack of proper formal training or information about the surrounding affected area and how the forest fire progresses for making a timely decision on what is and follow the safest evacuation route. Due to insufficient time or information, many potential victims tend to compromise on less beneficial or less appropriate evacuation routes. Thus, a forest fire emergency as a threat demands a new service using new ICT to facilitate the present assessment and evacuation processes as to assist relevant disaster management stakeholders in timely and informed decision making by accessing as much relevant information as possible about the current and projected state of the emergency. In turn, this

will assist disaster management stakeholders in producing and issuing relevant evacuation routes to potential victims as a safe way out of the threat. The proposed application service architecture should consist of a number of platform independent features such as support for real time data, resource access and integration from heterogeneous and distributed sources, flexible policies, experts' input, assessment processes and simulation tools. To address these issues, this paper proposes a matchmaking data push grid service to automate the information integration, access, assessment and matchmaking processes for disaster managers to produce and issue effective evacuation routes in a timely manner and for potential victims to timely receive and follow issued personalized evacuation instructions.

With this in mind, the contributions of the paper are to: i) present a background work including a case scenario for illustrating service requirements – using data flow diagrams – with respect to various stakeholders including disaster managers and potential victims; ii) offer an overview of relevant technologies including grid technology; iii) describe the data pull and push matchmaking processes; iv) present the service design encompassing a conceptual model and an activity diagram showing direct relationship with stakeholders' requirements; v) discuss and illustrate the technicalities involved to the proposed service architecture in the form of sequence data flow diagrams. These will clearly demonstrate the incorporation of automated access and assessment of information – that is integrated from various heterogeneous and distributed resources – using a matchmaking data push grid service for communicating timely and personalized forest fire evacuation routes to potential victims of an affected area. A mathematical analysis of the aforementioned data push grid service is also included.

2. BACKGROUND WORK

Natural phenomena are normal, unavoidable and necessary planetary actions, however they may cause instability to the human societies, often with serious losses in lives and environmental resources. Disaster management is the discipline responsible to mitigate, prepare for, response to and recover from disasters with the ultimate goal to save lives property and the environment. In managing disasters and in particular during the response phase, it is apparent that a number of teams and individuals from multiple, geographically distributed organizations are required to communicate, cooperate and collaborate in order to take appropriate decisions and actions (Graves, 2004; Otten et al, 2004). In particular, disaster managers and other experts are in close cooperation towards the design and implementation of services associated with risk management, early warning systems, disaster response and recovery to achieve sustainable development and livelihood.

An effective and efficient emergency response operation requires a number of collaborative technologies developed to assist the requirements of many segmented organizations to bring together their intellectual resources and to share accurate information in a timely manner (Graves, 2004; Howard et al, 2002). However, several obstacles arise in the design and implementation of such services. Many scholars in the field suggest that sustained efforts should be made with respect to data and resource archiving, sharing and dissemination. Recent disaster management approaches are inefficient due to their unstructured poor resource management and centralized nature with fixed hierarchical instructions (Asimakopoulou et al, 2006; 2009).

Amongst other natural disasters forest fires is an extreme phenomenon with rapid increase lately and it usually causes extensive damage to the local population, property, and local and global environment. A forest fire can be caused either by natural causes, such as hot days, or lightning, or by careless people and accidents. The European Union (EU) considers forest fires as a frequent event in the Mediterranean region, particularly during the summer season. Forest fires destroy large-scale areas of trees and other types of plants. Various forest fires occurred across the Mediterranean region and in particular in Portugal, France, Italy and Greece caused environmental destruction and a number of fatalities during the summer of 2007. According to the European Civil Protection 'in 2007 Greece experienced the worst year on record for forest fires. Extremely hot and dry weather conditions, combined with strong winds led to a disastrous upsurge of forest fires and wildfires. That year Greece requested assistance 4 times through the Monitoring Information Centre of the European schedule Commission to face during the months of June, July and August. The total burnt area amounts to 268,834 hectares, of which 180,000 burnt between the 24 and 30 August 2007' (EU, 2007). Further to these, during these events 5,392 people were affected and 67 of them killed – some of them were fire fighters – while the damage has been calculated to 1,750,000 US\$' (EM-DAT, 2008).

Except the large number of fires all over the country that had divided emergency management units in smaller groups, other conditions making their work difficult included the morphological characteristics of the area, which consists of a lot of mountains and valleys, the high temperature, which did not allow relevant aircrafts to operate continuously and the chaotic situation caused by overstressed residents of the affected areas, who could not logically follow emergency services' instructions. Further to these, TV channels, which in such situations are a source of information for the locals and a visual source of information for relevant disaster management authorities, could not closely approach all areas and further to this the flow of the news was limiting the timely fashion of information for a particular area. These difficulties resulted to people trapped by the fire. Some of them were killed; while for others emergency services lost vital time to save them. According to BBC NEWS some of them have been found burned on roads or within they cars – as winds were changing directions and individuals could not estimate the direction and the speed of the fire in relation to the nature of materials in its route. EU has experienced similar situations in Portugal (2005), Italy and Croatia (2008). It is crucial in such cases, for both emergency services and the public to know the most effective evacuation route. If this was known, emergency services could redirect people and safely evacuate the area and then solidly focus on the fighting of the fire alone (Bessis and Asimakopoulou, 2008).

2.1 Forest Fire Case Scenario: Improving the Current Practice

Southern Europe is an area with high vulnerability to forest fires due to its morphology and to the weather conditions it experiences, especially during the summer periods. The area is characterized by a rich morphology, which includes a lot of mountains, valleys, forests, hills, and rivers, temperatures that can reach 45-47°C, and very strong winds that can last for several days during the summer.

Let's assume that a number of forest fires occurred in a particular region like the one described above, which accommodates a number of cities, towns and villages. The fires have caused disruptions to some road network connections and many people have been trapped in different areas. We must emphasize that during the summer period there are also holidaymakers who are not necessary familiar with alternative road network connections. In this scenario, the disaster management stakeholders are responsible to work collaboratively in order to collect information about the affected area and the phenomenon, to assess it and to decide and issue emergency response plans in order to control the fire, as well as to safely evacuate the area and to protect the infrastructure of the region and the local environment.

Collection of such information is a continuous process and must take place via the integration of real-time alerting systems and other distributed and heterogeneous sources such as scientific instruments, geographical information systems, weather stations and satellites, mobile technologies carried by operational units located in the affected area, TV channels and finally calls made by victims requiring assistance. Disaster managers, and other experts collect and asses this data and by taking into consideration existing emergency plans, policies and availability and status of physical emergency resources, make decisions and form an emergency plan, which is issued and allocated to the relevant operational units. This is shown in fig. 1.

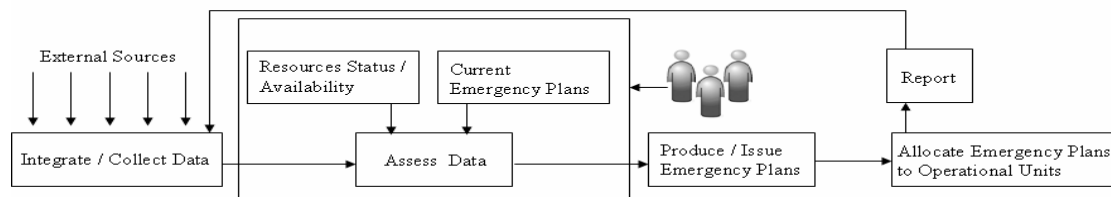


Figure 1. Current Emergency Response Decision Making Process

In this paper we propose an advanced forest fire evacuation system capable to identify potential victims and deliver to them relevant personalized evacuation plans even if rescue teams are not able to reach them. Current digital and wireless technology that is embedded in cell telephony is capable of reading, identifying and clustering groups of victims based on their exact positioning (cell area 1, cell area 2, etc) and pushing this information to the emergency operation center. Sensors could be placed across the fires and real time satellite images of the area to be received by disaster managers as tools to continuously read and monitor current fire activity. Data received could be analyzed in real-time and feed in to a number of collaborative decision support systems encompassing a simulation tool, which could forecast projected fire path based on

parameters like surround materials (sensitivity factor), wind speed, temperature, moisture, oxygen levels and other atmospheric readings. Another simulation tool could take the projected fire path simulation results and combine them with geographical maps towards the identification of possible local evacuation routes. The expectation is that this information would be critical for disaster specialists in order to make informed decisions and timely broadcast and push a number of currently suitable projected evacuation plans that are directly relevant to specific groups of victims based on their identical position across the region.

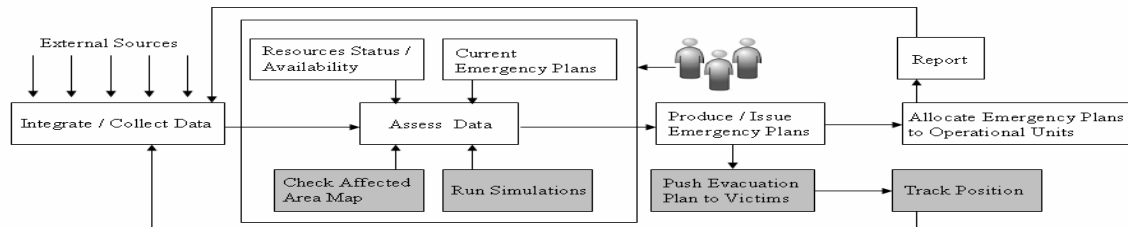


Figure 2. Proposed Emergency Response Decision Making Process

Current cell technology is capable receiving and transmitting signals from/to dispersed locations. We therefore propose that this technology could be used to read, broadcast and stream different digital signals encompassing different images (evacuations plans), which could be pushed to relevant groups based on their exact positioning. The method will clearly serve as a victim-led timely source of information alleviating concerns with regard to victims receiving a generalized flow of images and news that are best limited to present unrelated evacuation plans. Figure 2 illustrates our proposed data flow encompassing additional parts – of critical importance – to the existing processes shown in fig. 1 as an improvement to the current practice.

3. BRIEF OVERVIEW OF RELATED TECHNOLOGIES

Recent advances in computer networking and digital resource integration resulted to the concept of grid technology. The most important standard that has emerged recently within the grid technology community is the OGSA-DAIS (Open Grid Services Architecture – Data, Access and Integration Services), which as a data integration specification addresses the ability to allow users to specify ‘what’ information is required without having to provide detailed instructions on ‘how’ or ‘from where’ to obtain the information. Further developments in the area have resulted (Bessis and Chauhan, 2008) in producing services to automatically ‘keep’ users ‘informed’ of latest, relevant, specific changes about data that are registered within the grid application in which users have access to. In terms of standards, grid environments share the same protocols with web services (XML, WSDL, SOAP, UDDI) and their main difference is that of web services typically provide stateless, persistent services whereas a grid provides state-full, transient instances of objects.

Its applicability within this particular scenario resides on the aspect of grid technology being capable in providing disaster management teams with an infrastructure allowing seamless and flexible collaborative remote access to various resources (including data, computational power, software, satellites or any other resource instrumentation, which could virtually connected to/from a personal computer) that are stored in (and/or managed via) multiple autonomous, distributed and heterogeneous computers. That is to say, disaster management teams are now capable in remotely assessing and managing disastrous situations through the utilization of available collaborative tools in a much effective and efficient manner. The development of such an infrastructure will require the combination of various open source technologies like MySQL, Apache, AXIS, Tomcat, OGSA-DAI-WSI and JSP. Apart these, the service will require access to various distributed data, hardware, instrumentation and specialist applications (which may be proprietary or incompatible in nature) like databases, weather systems, satellites, geographical information systems, area maps, mobile and wireless communications, global positioning systems, simulation, data mining and decision modeling tools.

3.1 Data Pull and Push Matchmaking Models

In general, there are two models, namely the Pull and Push models, for a client to retrieve data from a data source. The distinction between the Pull and the Push models is shown in fig 3. In the Pull model, a web

client (W-C) needs to initiate a search by specifying search parameters. The web server (W-S) receives the client's request and it performs a data query to the database server (DB-S). If there are any retrieved data, these are made available to the web client via the web server. In this model, web clients are always required to initiate the search function in order to retrieve data. In the Push model, a web client (W-C) needs to subscribe by specifying a set of parameters and the period in which they wish to keep informed of any new and/or data updates occurring at the data source level, as relevant to the specified parameters. These parameters are stored as a new record in the subscriber's table (S-T) that is located in the web server (W-S). The Push approach as discussed in Bessis (2003) suggests that every time a data provider commits a new data entry in the database server (DB-S), a data description record (with reference to the new data entry) is generated and stored in a Data Description Table (DD-T). Once a record is stored in the DD-T, a trigger will cause an automatic search between the records stored in the DD-T and subscriber's table (S-T) to identify relevant matches. If there are any retrieved data, these are pushed to the client via the web server. In this model, web clients are required to subscribe once and are not required to initiate the search function every time new data are committed within a data source. In brief, user tailored Push technology enables a decision maker to specify a set of parameters into a subscriber form and as those conditions match specific parts of the newly updated and/or created content, such information are 'pushed' to the subscribed decision maker.

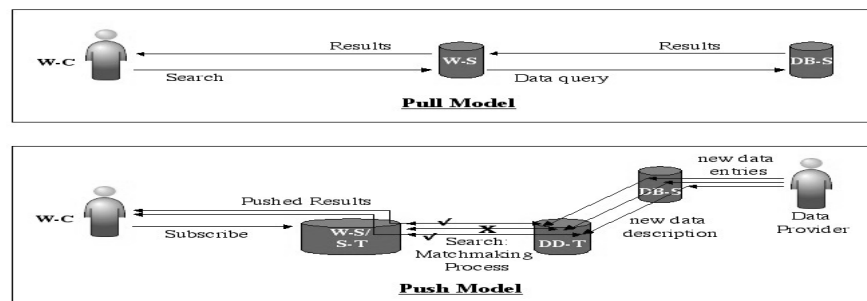


Figure 3. Sequence Diagrams of Data Pull and Push Models

Overall, Push can streamline the delivery of user tailored, specific information to a variety of users via the Internet or a web browser. There are various technologies including Web 2.0, AJAX, WS-Notification and/or WS-Eventing, supporting the development of pure or feel a-like push mechanisms. It is therefore the viewpoint that user tailored Push technology addresses data consistency, which it is an important property as it determines how 'relevant', 'accurate' and 'fresh' the data is. Updates within a distributed environment are more frequent compared to a centralized one and therefore, there is a need for updates occurred at the back-end to be migrated to other sites in the network so that all the copies of relevant and up-to-date data are synchronized to maintain consistency as well as preserving personalization of individuals across the stakeholders' community. These specific updates must be also checked about their consistency prior to a potential further action like a two or a three commit protocol when they have to be migrated to other sites in the network. It must be stressed that a two or a three commit protocol may not be an appropriate action since synchronization over a data grid refers to the data synchronization in the virtualized table layer and not in the actual data source layer. If however, it is required this will then enable all the copies of the data to be consistently synchronized and provide the homogeneous status that may be critically required by the stakeholders. On this basis, our view is that keeping all interested parties, including disaster managers and potential victims informed of fresh and relevant changes that are directly relevant to their interest will contribute to an efficient personalized and accurate service.

4. SERVICE DESIGN

The section presents the service design encompassing a conceptual model and an activity diagram showing direct relationship with stakeholders' requirements. These clearly illustrate how an advanced forest fire evacuation service within a fluid and dynamically changing environment can assist in a disaster management setting and in particular in the response to a threat such as a forest fire.

Figure 4 shows the back-end of the proposed forest fire evacuation data grid push service (FFED-GPS) in the form of a conceptual model. It illustrates the entities involved during an emergency response decision-making process. The conceptual model is centred on six core entities including the Disaster_Manager, Service_Type, Assess_Service, Antenna, Evacuation_Plan and the Victim. We appreciate that there are other entities, which are not shown and others, which are included in our proposed model however, these are considered of less importance when describing our rationale yet they are of critical importance in terms of the overall model's operational order. There are also a number of weak entities (shown as empty entities encompassing composite keys, which are combined primary keys from the relating entities) representing the resolution between many to many relationships. In our model, arrowheads denote many relationships. Finally, the model appreciates that some of these relationships are optional but these are not denoted on the diagram in order to reduce complexity. For this reason, relationship names have been also omitted.

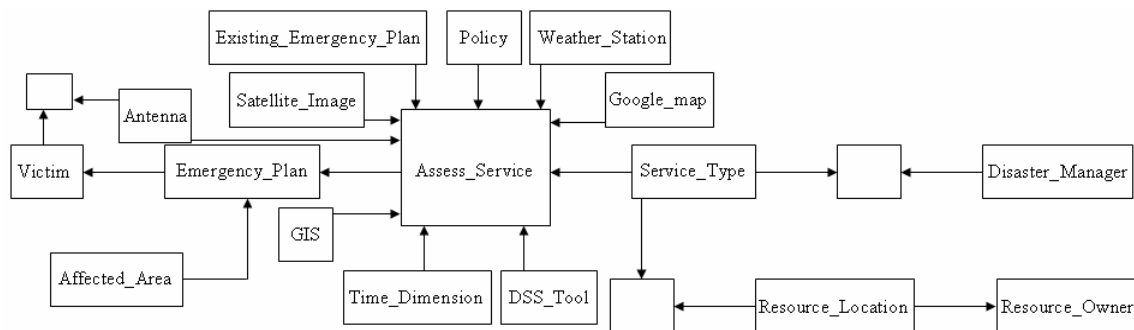


Figure 4. FFED-GPS Conceptual Model

Our rationale assumes that a Disaster_Manager invokes one or many Service_Type(s), which as an entity provides disaster managers with access to various dispersed resources via the Assess_Service(s) entity. Such resources include but are not limited to heterogeneous data and tools collected from a number of entities like the Weather_Station, GIS (Geographical Information System), Satellite_Image(s), Google_Map(s) and Time_Dimension. The Assess_Service(s) entity recalls the action of 'start collecting and integrating' a fresh image of the aforementioned dispersed data. It is also assumed that the Assess_Service(s) entity invokes the same action when an alerting situation occurs. The latter entity provides access to relevant and fresh data for an affected area. It also provides access to the Antenna entity, which continuously takes readings about the victims exact positioning via their registered mobile phones (cell area 1, cell area 2, etc). At this stage it is important to emphasize that the proposed system is a support mechanism, which does not aim to replace existing practices. Finally, the Assess_Service(s) entity provides access to available Existing_Emergency_Plan(s) and, various decision support systems, data mining and simulation tools (DSS_Tools), which are important to the disaster managers' decision-making process. In turn, these should allow disaster managers to collaboratively produce and issue a relevant Evacuation_Plan to relevant parties such as operational units and victims. The model also annotates other entities like Resource_Location, which provides information about where resources like fire brigade vehicle or a cluster awaiting a simulation to run is located. The model also appreciates entities like Resource_Owner, Affected_Area and Policy. The latter entity keeps data about who has access to.

The Assess_Service entity consists of attributes providing information and actions such as system calibration, start collecting, start integrating, accessing, combining, self-assessing and validating, monitoring, alerting, run what-if simulation scenarios and so on. This entity is consider to be the heart of the system as it will allow a disaster manager to forecast projected fire path based on parameters like surround material (sensitivity factor), wind speed, temperature, moisture, oxygen levels and other atmospheric readings. This will also assess the projected fire path and combine it with geographical maps (from satellite images, GIS and/or google maps) towards the identification of possible evacuation routes. It is anticipated that these will be informed with readings taken from the Antenna entity, which as mentioned earlier will provide exact positioning readings of victims. On this basis, disaster managers can produce relevant and personalized evacuation plans, which can then be issued or pushed to relevant parties such as operational units or victims.

Figure 5 illustrates the FFED-GPS service front-end layer in the form of a UML activity diagram. This layer demonstrates service functionality and offers the option to a disaster manager to manually or to

automatically control, access, integrate and monitor the flow and communications between dispersed data, which are made available via various entities. In particular, the FFED-GPS performs user credentials and service authorization checking prior to accessing any services. It will then allow the disaster manager to start collecting and integrating data from various dispersed resources. We must emphasize the importance of collecting data from the Antenna receiver service. These incoming reading messages are of critical importance as they continuously provide victim's exact positioning readings. These, alongside with location's maps can be used to simulate efficient evacuation routes leading to a disaster manager producing a suitable evacuation plan. The latter is pushed to the victim via the antenna transmitter. Finally, the monitoring/tracking function follows victim's reaction and assesses whether the victim arrives at a safe place.

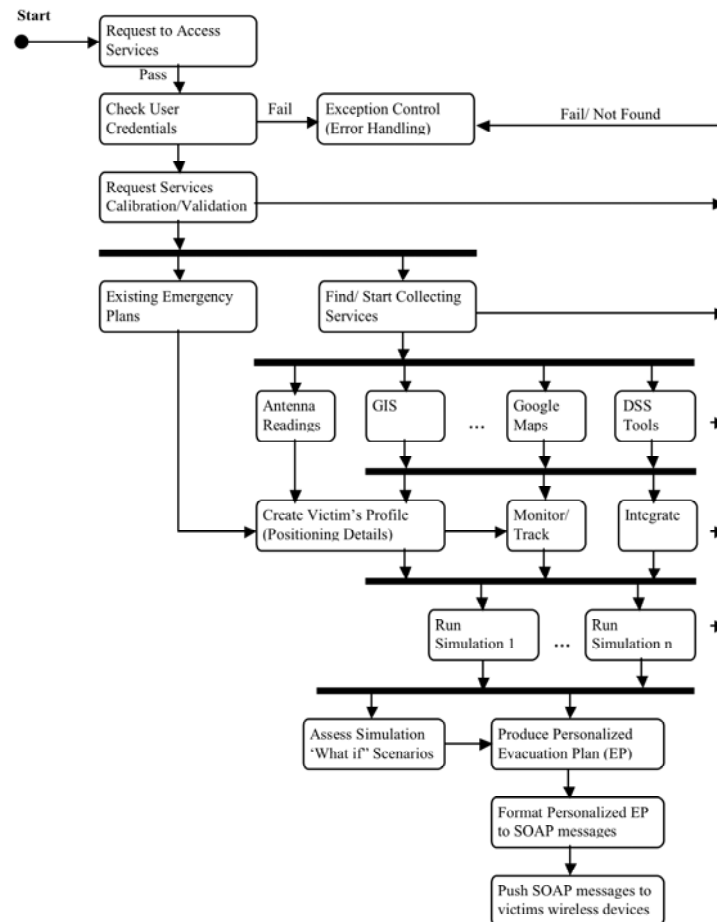


Figure 5. FFED-GPS UML activity diagram

5. SERVICE ARCHITECTURE

This section discusses and illustrates the technicalities of the proposed service architecture in the form of sequence data flow diagrams. These will clearly demonstrate the incorporation of the automated use of a matchmaking data grid push service for communicating timely and personalized forest fire evacuation routes to potential victims of an affected area. A mathematical analysis of the FFED-GPS is also included.

5.1 The Process Flow Architecture of the FFED-GPS

Relevant architectures and the implementation of such a data-push grid service have been extensively discussed in Bessis and Chauhan (2008) and in Bessis (2009). Our purpose here is to extend these to suit designing a data-push grid service enabling disaster managers producing informed and safe evacuation plans in a timely manner to people of an affected from a forest fire area. Our proposed FFED-GPS assumes that a victim of an affected from a forest fire in progress area is an owner of a wireless device like a mobile phone. Our rationale suggests that an Antenna will capture exact positioning readings of a victim like <Victim_A> as shown in fig. 6. These readings are then stored in the <S_GR> that is the victim's subscription grid registry. Once these readings are stored, a victim's profile is created in <S_GDSF> that is the victim's subscription grid data service factory. These are shown as simplified actions, including Actions 1-3 and 6.

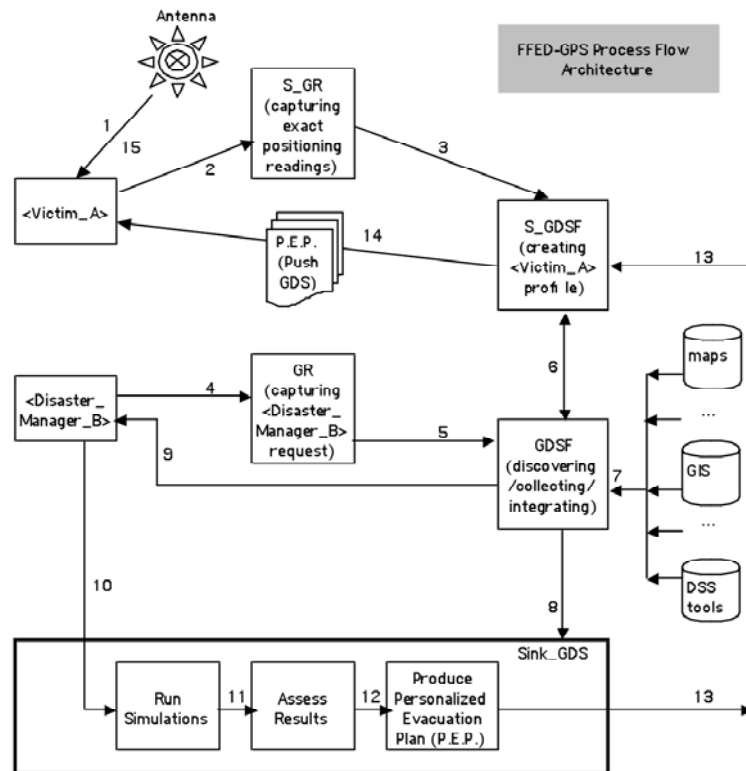


Figure 6. FFED-GPS Process Flow Architecture

We assume that a disaster manager like <Disaster_Manager_B> has been assigned to identify a safe evacuation plan for <Victim_A>. The <Disaster_Manager_B> is required to register his request as to access available services. The request is saved in the <GR> and moves to the <GDSF>, the factory, which takes care of start collecting and integrating data and tools from, disperse and heterogeneous resources like a GIS, google maps, DSS tools, etc, which must be register with <GDSF> prior to their availability. Once matches are found, the <GDSF> will make results available through the <Sink_GDS>, a grid data service encompassing all aggregated results. The <Disaster_Manager_B> is now able to run simulations and assess various evacuation paths for producing a personalized to <Victim_A> evacuation plan. Once the <Disaster_Manager_B> is satisfied about the plan, this is made available at the <S_GDSF>, which will push it automatically to <Victim_A>. These are shown as Actions 4-5 and 7-15. The following list summarizes all aforementioned actions:

- Action 1: The Antenna as a "Service Requestor A" establishes connection with <Victim_A>;
- Action 2: The Antenna as a "Service Subscriber A" starts capturing <Victim_A> exact positioning readings and passes them to the <S_GR>;

- Action 3: <S_GR> sends a request to the Subscriber Grid Data Services Factory <S_GDSF> to create <Victim_A> profile;
- Action 4: The <Disaster_Manager_B> as a “Service Requestor B” requests to register his query to access services via the <GR>
- Action 5: The <GR> requests <GDSF> starting collecting/integrating resources registered to it;
- Action 6: The <S_GDSF> sends the request of collecting and matchmaking process to the <GDSF>;
- Action 7: The <GDSF> sends requests to registered resources;
- Action 8: The <GDSF> returns results to the <Sink_GDS>;
- Action 9: The <GDSF> informs the <Disaster_Manager_B> to access the relevant results;
- Action 10: The <Disaster_Manager_B> runs ‘what-if’ simulation scenarios via the <Sink_GDS>;
- Action 11: The <Disaster_Manager_B> assesses simulation results via the <Sink_GDS>;
- Action 12: The <Disaster_Manager_B> produces a personalized evacuation plan via the services available from the <Sink_GDS>;
- Action 13: The <Sink_GDS> pushes the personalized evacuation plan to the <S_GDSF>;
- Action 14: The <S_GDSF> pushes the personalized evacuation plan to <Victim_A>;
- Action 15: The Antenna maintains connection with <Victim_A> wireless device for monitoring and tracking victim’s positioning and movement (loops actions 1-3, once <Victim_A> moves to a safe place and according to the personalized evacuation plan, S_GDSF deletes <Victim_A> profile).

5.2 Technical Considerations of the FFED-GPS

The implementation of such a dynamic service incorporates the combination of web services standards (XML, SOAP, UDDI and WSDL) and open source technologies like MySQL, Apache, Jakarta Tomcat, and AXIS. The technical architecture as shown in fig. 7 suggests the automatic creation of an XML register/subscriber file consisting of victims’ real-time exact positioning readings taken from the Antenna entity, which feeds automatically the victim’s subscription form.

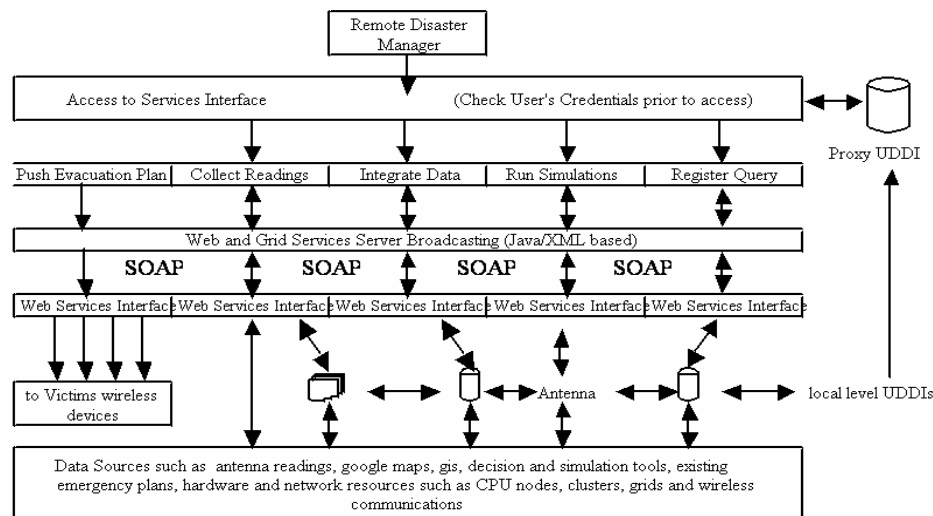


Figure 7. FFED-GPS Technical Architecture

The XML file is stored at the ‘victim_profile’ proxy database (UDDI level) that is attached to the Antenna entity so it can be found from the GDSF. The XML file continuously registers exact positioning readings by monitoring and tracking individual’s exact positioning and movement. These are then compared with projected forest fire paths and assessed – via simulations – to identify available evacuation routes using google maps. When these are found, a trigger creates a personalized SOAP message, encompassing individual’s evacuation plan and automatically pushes the personalized SOAP message to the registered/subscribed victim.

5.3 The Mathematical Analysis of the FFED-GPS

The FFED-GPS architecture is based on the following mathematical rationale. Let f be a function from a Service Request (S) to the Registry Query (R) such as: $f: S \rightarrow R$, i.e., $r = f(s)$; $r \in R$, $s \in S$. Let g be also a function from R to Factory (F) such as: $g: R \rightarrow F$, i.e., $f = g(f(s))$; $r \in R$, $f \in F$. Similarly, let h to be a function from $g(f(s))$ to <Sink_GDS>, then: $h: F \rightarrow P$, i.e., $p = h(g(f(s)))$; $f \in F$, $p \in P$, then $\psi = h(g(f(s)))$ where ψ is a function from databases (T) such as GIS, google maps and DSS tools to <Sink_GDS> (P) and defined as: $\psi: T \rightarrow P$; $p \in P$, $t \in T$. As there are several services requests these lead to corresponding registry queries. The <GDSF> and <Sink_GDS> will require accessing: $\sum_i (s)$, $\sum_{g_i} (\sum_i (s))$, $\sum_{h_i} (\sum_{g_i} (\sum_i (s)))$, respectively. Results are then made available from the $U\psi_i \sim \sum_{h_i} (\sum_{g_i} (\sum_i (s)))$ formula.

6. CONCLUSION

In this paper we used a case scenario to describe the FFED-GPS, a data-push grid service enabling disaster managers saving people when a forest fire is in progress. In particular, we conceptualized the way in which cell digital signal technology (receivers and transmitters) could be used within a grid infrastructure as a method to locate groups of victims and push them evacuation routes based on their exact positioning. To achieve this, we suggested the use of wireless communications as to identify affected area peoples' exact positioning. We also suggested the use of grid technology as to support the collection and integration of dispersed heterogeneous resources. In turn, disaster managers can use these to access current state of road networks, assess the overall situation and ultimately produce safe and timely evacuation routes via running multiple 'what-if' scenarios and simulations. With this in mind, we described in detail the service design and architecture using data-push in grid environments enabling disaster managers pushing automatically personalized forest fire evacuation plans to people of an affected area.

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INDUSTRIAL QUALIFICATION SUPPORTED THROUGH A KNOWLEDGE MANAGEMENT SYSTEM

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ABSTRACT

Knowledge management involves representation and knowledge processing by organizations, people and machines, and leads to the decision making process. Decision support systems have been used to represent and process knowledge that is of interest to decision makers. This work presents a tool that supports the knowledge management in the professional qualification process of the production area in a large Brazilian industry – Petrobras. The company has several units scattered throughout the country and constantly absorbs new employees. In the studied context, the oldest employees have unique expertise; thus, the challenge is to maintain an organizational structure that allows the passage of knowledge to beginners and creates a culture of storing this knowledge for future generations. Petrobras has Formation and Qualification programmes to its employees and has developed a system that supports these processes through the capture of pre and post-qualification knowledge, criticisms and suggestions from employees and knowledge acquired during the process of learning. This article introduces the learning environment, some experiences and the results of using the system proposed.

KEYWORDS

Knowledge Management, Industry Qualification, E-learning Systems, Decision Making Process

1. INTRODUCTION

Organizations, regardless of their size, hold valuable intellectual capital. Allied to that, in the highly competitive environment, knowledge is considered as the source of competitive advantages that can be managed by the organization (Oliveira et al, 2006; Drucker, 1999). Employee training and development programs, organizational policies, practices, procedures, reports, manuals, and procedures have been used in knowledge distribution for years, showing that organizational and administrative practices are increasingly focused on knowledge (Alavi and Leidner, 2001; Grant, 1997; Spender, 1996).

Today, a successful organization is one that is able to learn constantly. All the time, knowledge can pass from tacit to explicit form or vice versa (Nonaka, 1995). In this context, it is a major challenge to become the knowledge that is in the individuals mind in organizational knowledge, shared by all the ones who need it. Besides, proficiency in knowledge management is increasingly important to the competitiveness of decision makers as the world moves rapidly into the global knowledge society (Holsapple, 2001).

Then, it is in this context that Knowledge Management finds its place. Its main goal is to make the organization proactively and effectively respond to changes in a highly unpredictable external environment, and encourage individuals to exchange their knowledge amongst themselves and contribute to organizational knowledge (Davenport et al, 1997).

In the present work, knowledge management initiatives taken in a large Brazilian oil company and the main achieved results in the current management are analysed. The rest of paper is organized as follows: section 2 presents related work in the area of knowledge management, e-learning systems and such aspects in

Oil and Gas Industries. In section 3, the environment's context is described, while section 4 explains the information system which supports the learning processes discussed. Finally, section 5 introduces the current results, concludes the paper and suggests further research steps.

2. LITERATURE REVIEW

In this section, the background description of knowledge management, e-learning systems and knowledge management and e-learning in industries are introduced.

2.1 Knowledge Management

In recent time, people need to acquire huge volume of knowledge faster than in the industrial revolution, for example (Rezende et al, 2006). As a result, organizations have been attempting to adopt manners to stimulate collective and collaborative learning methods, assuming a role that should only be the government's, but due to globalization challenges, organizations have been offering education opportunities to employees and outsourcers.

According to Lufman and Brier (1999), organization's modifications are related to the processes adopted, the internal structure, the new environment formed as well as the technological advances and systems implemented. The emergence of such volatile situations within organizations has resulted in the rapid increase of the associated management risks and uncertainties regarding the progress, productivity rates, resource allocation, schedules and costs of organizations projects. These settings highly influence the processes and social relations between people and organizations causing significant changes in the corporate strategies.

Therefore, knowledge management is applied as an engine to guide organizations in a dynamic and efficient manner during the constant changes – internal and external – imposed by globalization issues. Furthermore, it is suggestive knowledge dissemination through whole organization to improve employees' know-how once the amount of individual skills compose the organization intelligence (Oliveira et al, 2006). Seemann et al. (1999) highlight that knowledge management can be viewed of as the deliberate design of processes, tools and structures in order to increase, renew, share and improve the use of knowledge represented in any of structural, human and social elements of intellectual capital.

Therefore, leaders must stimulate the building of human capital in organizations by identifying and recruiting talents for work (Bohlander and Snell, 2007). Additionally, the authors emphasize the importance of sustainable training programs within multiple organizational settings once training programs may facilitate the needs of the knowledge worker in meeting job requirements (McFarlane, 2008; Kirkpatrick and Kirkpatrick, 2006).

2.2 E-learning Approach

Training methods are very important to ensure that company employees know the latest information and advanced skills to his/her functions. In recent years, knowledge-based economy has exhibited an increasing demand for innovative ways of delivering education (Zhang et al, 2004). E-learning has become one of the most important educating ways to break down limits of space and time, reduce learning costs and improve learning efficiency (Zhao et al., 2007).

Many E-Learning systems have been developed with many differenced learning services. These systems aim to improve science education providing high quality educational resources for learners and helping them to build up their own understandings (Gu and Sumner, 2006).

There are many advantages in using e-learning systems for educational purposes. Bates (1997) points four of them: (i) to improve the quality of learning, (ii) to improve access to education and training, (iii) to reduce the costs of education, and (iv) to improve the cost-effectiveness of education.

As previously said, Petrobras has people with many different backgrounds from various educational institutions and instruction levels. Then, it is advisable that knowledge be unique and there is a need for personalization of study. E-learning technologies and knowledge management can provide this

personalization and employees can be provided by more effective learning environments to optimize their learning.

2.3 Knowledge Management and E-learning in Industries

Many oil and gas companies (Chevron, BP Amoco, Imperial Chemicals Industries, PDVSA, and so on) have been adopting knowledge management procedures and taken advantage of knowledge management (Leavitt, 2002). Some of these advantages are increasing stock market valuation, growth through acquisition, better-developed products, and encourage intelligent leadership for tenacious early adopters, and so on.

One example of adoption of learning and knowledge management in oil companies comes from Shell Oil Company. It has been investing in KM initiatives since 1994 and in the same year Shell created the “Shell Learning Center” to focus on leverage of its organizational knowledge. Initially, the program focused on the top 200 Shell leaders, but today, it is extended to all employees (Hackett, 2008). The program’s main proposition is “to leverage the cutting-edge tools of learning to improve business performance and to provide a platform for the leader development of high-potential employees”.

Another example of KM into procedures is Petronas (Petronas, 2008) through the creation of a unit to work in this context inside its Petroleum Management Unit with the vision that “an organization which leverages on its vast knowledge and Information to maximize value creation for Malaysia’s E&P business”. To achieve this, Petronas has developed a framework with 8 main focuses: Physical, Architecture, Structural Design, Living k-policy, K-tools, Human capital and Technology.

3. CONTEXT

The environment studied in this work is the Professional Formation and Qualification model as used at Petrobras. The company is divided into several business units spread throughout Brazil that can be seen as oil product manufacturers. Its employees are commonly known as operators (Petrobras, 2003). The workforce diversity is immense and its know-how is unique in the country. Petrobras Supply area held for 8 years the Professional Qualification Programme of their workforce (about 5,000 employees) through courses and diagnostics programmes.

Petrobras often has openings and hires new employees. Like most companies, Petrobras has employees from the most diverse academic backgrounds, prepared by several Brazilian educational institutions. However, due to the peculiarities of the work, all applicants have to go through a default course, a Preparation Course, which lasts about 500 hours, divided into about 40 modules. This Preparation Course, named Professional Qualification Programme, is directed to new employees. On the other hand, the company also worries about the older professionals. For this audience, there is a Professional Qualification Programme whose goal is to evaluate their knowledge and provide specific qualification courses, when necessary.

There are several procedures involving the maintenance of Formation and Qualification processes. As well as in educational institutions, Petrobras offers courses for its employees and uses tests to assess the personnel. Similarly, the company has a system to record criticisms and suggestions, and to provide performance reports. These procedures are closely managed by an information system, detailed in the following section.

The knowledge management approach is quite similar to the Nonaka and Takeuchi (1995) researches, which have one of the most widely referenced studies from knowledge management perspective – the knowledge matrix. This study classifies knowledge as explicit or tacit, and as individual or collective. The authors explain knowledge transformations, such as socialization, from tacit to tacit, when an individual acquires tacit knowledge directly from others through shared experience and observation; externalization, from tacit to explicit, through transformation of tacit knowledge into explicit concepts; combination, from explicit to explicit, through a systematization of concepts illustrations on different manners of explicit knowledge; and internalization, from explicit to tacit, through learning by doing process and also by articulation and best practices’ documentation.

In Petrobras Industrial Units, these four transformations are commonly observed during the qualification and formation processes. Figure 1 depicts how succinctly the knowledge management and e-learning practices in the organization work.

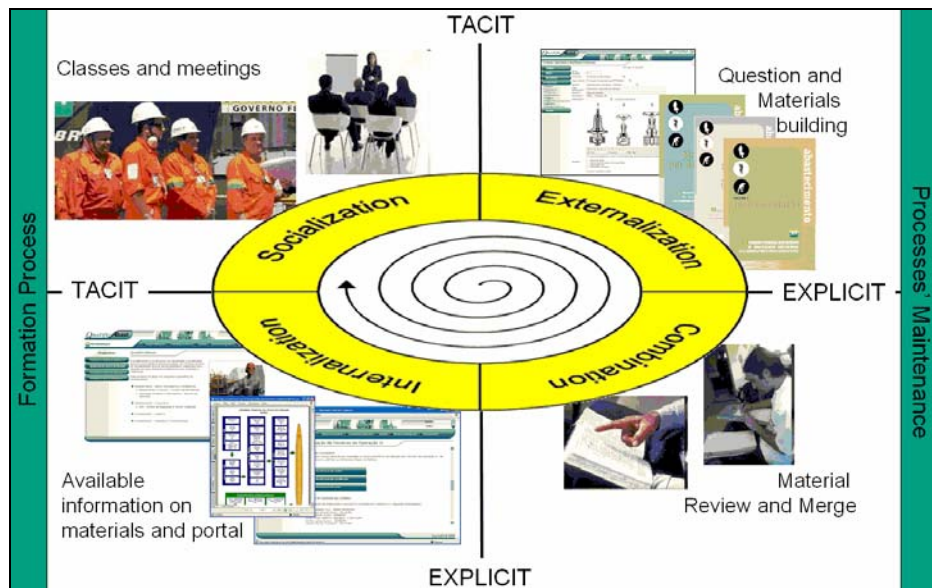


Figure 1. Workforce Training Structure in Industrial Unit areas

To support the managerial characteristics, the human resources sector regards with external credentialed institutions which has specific training responsibilities such as to store students' personal data in the system, guided on the operational aspects of courses, manage notes and deeds, capture criticisms and suggestions, provide teaching material and give the operational support during diagnostic tests. As there are several industrial units geographically scattered in Brazil, these external organizations play an important role in the involved training processes as well as an integrative web system which supports the internal and external procedures.

4. INFORMATION SYSTEM

Towards to support the process, a web system was developed to maintain and control the main Qualification and Formation Programmes in Petrobras Industrial Units. It is known that the investment of Information Technology impacts on different stages of business operations (Chen, 2006), so Petrobras has increased its innovation, deepwater oil exploration, organizational and technical investments (Brazil, 2007) and this indirectly affects the finding of a particular form of integration among its qualification's projects through information technology. There are studies that affirm that organizational performance is higher when it is possible to maintain a singular strategic focus – a specific system, in this case – as opposed to a multi-focused strategy (Tallon, 2007); thus, the use of several computational tools to control each qualification process would be a wrong decision.

Therefore, this integrative system, named QualificAbast, has two main areas: a public external (internet) access and a restricted internal (intranet) web area. Examples of such interfaces' design is showed in Figure 2. The public access is designed as a web portal which provides detailed information about didactic routes and the involved educational professionals in the processes of the Training Program for Technical Operation. This external website works as a communication channel among processes' coordinators, facilitators and students through the public information posting and also with people interested in a greater knowledge of procedures. There are some interactive mechanisms, such as frequently asked questions, area for criticisms and suggestions, training schedule searches, web forum and wiki.

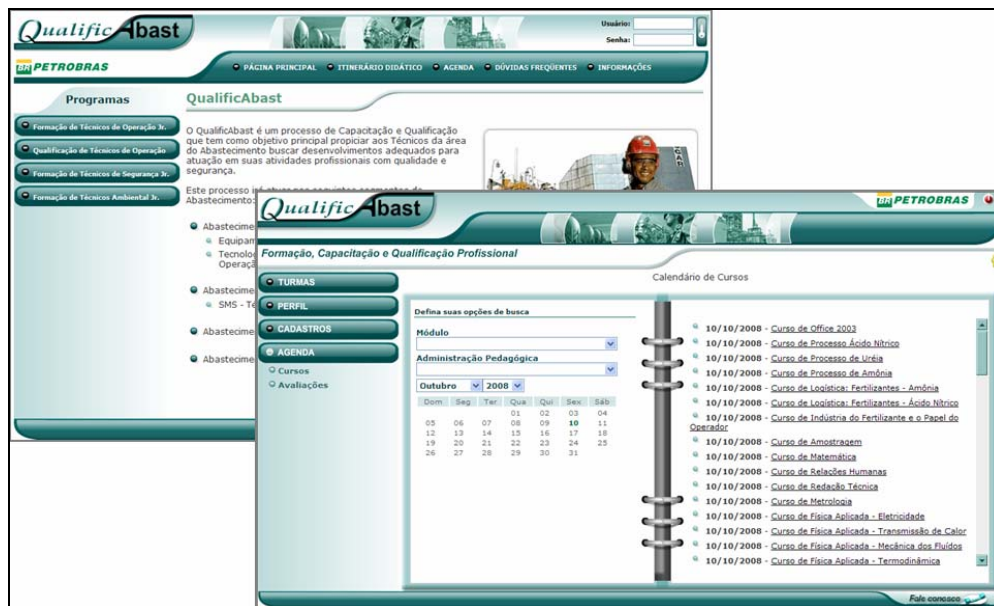


Figure 2. Examples of public and restricted system's access

The restrict area allows the technical and pedagogic maintenance and has several profiles, such as (i) National Administrator, who accesses all information of all Industry Units through reports and usual interfaces and provides permissions to other profiles; (ii) Local Administrator, who views only information about his/her Industry Unit, has permission to create and manage Formation and Qualification courses and can modify students' registers; (iii) Pedagogic Administrator, who has access to interfaces for training courses maintenance, such as changes in presence and ratings; (iv) Elaborator, who creates and maintains diagnostic questions; (v) Instructor, who accesses only the interface to modify presence and grades; (vi) Technical Operator, who can view training courses, do the diagnostic tests, make suggestions, interact with other users and consult scholar history.

Several are the procedures in the restricted area that involve the maintenance of the Formation and Qualification process. Like an educational institution, Petrobras offers courses for its employees and uses tests to diagnose them. Similarly, the company provides tools to register criticisms and suggestions, and performance reports. These procedures are strongly managed by the system and will be thoroughly explained in the next section.

5. PROCESSES MAINTENANCE

In the Qualification Programmes, employees are given the chance to attend different disciplines. However, each course has a significant burden for both the company, which will have to bear all of its costs, and for the employee, who may be spending time doing a course whose content is already deeply known.

The solution in this case was to assess the technical operators before the course started, i.e., namely to verify if there were a real need for improvement. Thus, the operator has the opportunity to eliminate some modules without attending the entire course, avoiding time loss due to absence from work. On the other hand, if the student requires a learning improvement through specific courses, it is also necessary a test to diagnose it.

This diagnosis is done directly in the information system (Figure 3) and consists in carrying out specific tests that indicate if the employee has the full abilities required to perform activities for the previously defined work. Tests taken in the computer are also used in the Operator Formation Process.

Figure 3. Test Question Example

After the course or test completion, the system suggests to each employee to outsource his/her criticisms and suggestions through an electronic document shown in Figure4a. This document holds personal opinions, formed by a set of objective questions and a field for comments. The stored information is used to evaluate qualitatively the programmes offered by the company and measure the strengths and weaknesses of these processes.

Figure 4. Interfaces a) Suggestions and criticisms and b) Test Questions Maintenance

The electronic evaluation is critical to understand the gaps exposed by the players in the process. This evaluation is very useful, for example, as an input in the process of recasting test questions (Figure 4b). When a question draws too many challenges, those who prepared it have the chance to evaluate its criticisms and change its contents, or even invalidate it. The system also provides a mechanism to reward questions' scores for student in whose test there were mistakes.

In addition to these information maintenance tools, the system also provides mechanisms for dissemination through a public portal. In this case, Administrators can use the restrict area to register and choose information to be public, where people outside the company can view the programmes offered and the main actions for continuous improvement.

6. ESSENTIAL RESULTS

During the system lifetime, various programmes have been created and significant results have been achieved. Under the umbrella of Formation and Qualification processes, about 120 classes were held. This number corresponds to the formation and qualification of almost 2,000 professionals who currently work in the company.

Another important data refers to the institutions and professionals who support the processes, managing the courses and diagnostics, and supporting the maintenance of teaching resources. In the measured period, 30 institutions that support the processes were accounted for, with about 300 writers of didactic materials, in a system that currently has 325 registered instructors.

The volumes of data related to tests are tremendous, as the system currently has a collection of 10,000 test questions, with a significant participation of students in the electronic tests, as the system stores around 40,000 notes. Another important collaborative aspect is the existence of 6,000 criticism / suggestions recorded, which is making the generation of innovation and continuous improvement increasingly participatory.

7. CONCLUSION

This article presented a system designed to support the employee's Formation and Qualification processes through the capture of pre and post-qualification knowledge, criticisms and suggestions from staff, and knowledge acquired during the learning processes. The decision on whether or not the organization should invest in technology was complicated once the decision makers needed to determine if the company had sufficient management skills and ability to adapt its behaviors and processes to successfully manage a new training approach.

As many other Oil Companies around the world, Petrobras has been sponsoring its staff training and qualification. Then, Petrobras continues investing in innovative systems once, nowadays, it is possible to measure how important this process is. As it is, the system is in constant evolution, to address many other features that support knowledge management and new satisfactory results are expected.

The challenge of establishing an e-learning and knowledge management effort is generally difficult once few people really know how important this process is. However, the essential results of this work showed significative numbers which denote, during Petrobras Qualification Process, how involved the professionals were. The next goal is to encourage knowledge sharing among all 5.000 Fabric Unit employees as part of their everyday work. To keep this approach building across the entire organization, the system will be constantly upgraded to improve knowledge management maintainance.

For further works, the system will be continually used to support the qualification process and features such as knowledge extraction mechanisms from the didactic material will be addressed. In addition, competence mappings to each employee is desirable and works in this direction will start. Moreover, new managerial reports have been developed and computer graphs applications have been inputted in the system.

ACKNOWLEDGEMENT

This research was funded by Petrobras, CAPES, CNPq, and the COPPETEC Foundation.

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ASSESSING THE DRIVERS OF VIRTUAL KNOWLEDGE MANAGEMENT IMPACT IN EUROPEAN FIRM'S PERFORMANCE: AN EXPLORATORY ANALYSIS

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ABSTRACT

E-Business is a phenomenon that has progressed over the past decades at record speed, with considerable promise and hype. It has been embraced with varying degrees of enthusiasm and impact by both large firms and Small and Medium Enterprises (SME). Parallel with its development, E-Business has attracted research interests, seen in a plethora of new modules, programmes, models and tools. Knowledge Management (KM) is one tool that seems to gain a more relevant role, especially as managing knowledge has become increasingly important to all companies. Appropriate KM practices within organisations can be seen as one of the prerequisites to the enhancement of continuous performance improvement in the internet-based context. Thus, our aim is to develop a conceptual framework related to KM practices in a virtual context and to identify the nature of the relationship existing in those knowledge-driven elements and performance achievements. This paper aims to bridge the gap between the KM and e-business performance-related literatures from the viewpoint of European firms by establishing a model tested in European companies. For this purpose, we used a structural equation modelling analysis. The results show that KM has a positive impact on the maximization of e-business performance and that some elements individually have a positive influence on e-business performance. As limitations of the study, we consider the need for more research into this field and the inclusion of new elements such as technological readiness and management support to KM initiatives. The present study advances knowledge on the nature of the relative importance of different components of Internet-based KM as drivers of e-business performance and reinforces its importance as an integrated e-business tool.

KEYWORDS

Knowledge Management, e-business, performance

1. INTRODUCTION

In today's digital economy, rapid access to knowledge is critical to the success of many organizations (Liao, 2003). One of the major challenges that firms face is managing competitive advantage through the development of strong relationships with all stakeholders. In this context, Knowledge Management (KM) becomes an important part of the global solution.

However, as noted by Takahashi and Vandenbrink (2004) and Zhang and Zhao (2006), KM needs to be regarded as more than simple information gathering in order to take advantage of its competitive potential. Despite the academic research and organizational practices developed around this concept, there is still a lack of conceptual basis necessary to develop the measures of KM contribution in business success, especially regarding its contribution to Internet-based environments. The objective of this paper has been to gain a clearer understanding of the fundamental issues related to this topic.

In this line of research, the present paper discusses the results of an exploratory survey conducted among a large sample of European companies. Using a structural equation analysis, we explore the relationship between e-business performance and KM initiatives, trying to identify the main drivers of virtual KM.

This paper has six sections and is organised as follows. Section 1 contains a brief background for this research. Section 2 presents the definition and process of develop knowledge inside an organization. Section 3 defines virtual KM, its advantages and its differences from traditional KM. A virtual KM evaluation framework is developed in section 4. In the last two sections we conclude our study, reiterate the major points and suggest avenues for further investigation.

2. DATA, INFORMATION AND KNOWLEDGE

During the last decades there has been an ever-growing interest within the fields of databases, information systems, and knowledge-based systems (Aamodt & Nygård, 1995). How should data, information, and knowledge be characterized so that their differences — and other relationships relevant for high achievements in the Internet environment — are identified?

The distinction between data, information and knowledge has been discussed for centuries in general, and within the database and information systems and marketing communities for several years. Nothing has resulted in a final conclusion. Between 2003 and 2005, a study titled “Knowledge Map of Information Science” tried to bridge this gap, collecting more than one hundred different definitions of data, information and knowledge. The conclusions present by Zins (2007) pointed to the existence of five different models (see Figure 1).

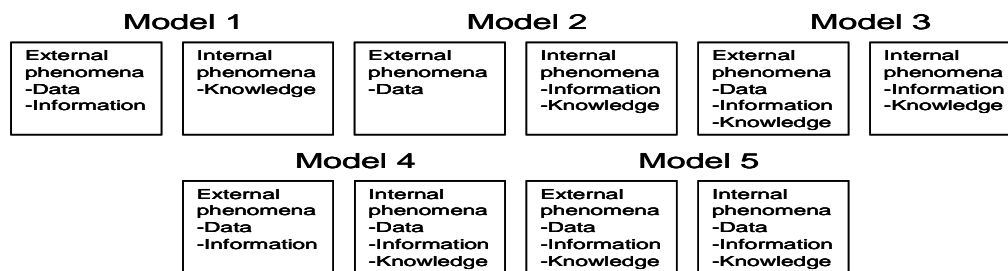


Figure 1. Five combinations of data, information and knowledge (Adapted from Zins, 2007)

Looking closer at each of these concepts, a base for our own model can be established. However, in describing these three concepts, it is not these researchers' intention to give a complete or historical review of the available literature. Davenport & Prusak (1998) have defined data as a set of discrete and objective facts about events. Using this definition, a crucial idea emerges: all firms need data, and to some of them, data can be critical. However, data only describes a part of the phenomenon without providing any kind of interpretation or support basis for actions. Even though data by itself has little or none relevance for firms, it is primordial material for information creation.

The same authors note that people can transform data into information through the addition of value in diverse forms: contextualized, categorized, calculated, correct and condensed. Thus, information consists of those significant regularities residing in the data that agents attempt to extract from it. In this sense we can summarize that information is an extraction from data that, by modifying the relevant probability distributions, has a capacity to perform useful work on an agent's knowledge base (Boisot & Canals, 2004).

As pointed out by several authors (see, Table 1) the relation between information and knowledge is a source of much confusion and misunderstanding. For instance, Maholtra (2000) interprets knowledge in terms of its potential for action and its link to performance, as opposed to information as external phenomenon that only has potential for improvements.

Table 1. Some definitions of Knowledge and Information (Adapted from Stenmark 2002)

Author(s)/ Year	Information	Knowledge
Wigg (1993)	Facts organised to describe a situation or condition	Truths and beliefs, perspectives and concepts, judgements and expectations, methodologies and know-how
Aamodt and Nygård (1995)	Information is interpreted data	Knowledge is learned information
Nonaka and Takeuchi (1995)	A fluid of meaningful messages	Commitments and beliefs created from these messages
Spek and Spijkevet (1997)	Data with meaning	The ability of assign meaning
Davenport and Prusak (1998)	A message meant to change receiver's perception	Experience, values, insights and contextual information
Choo et al (2000)	Data vested with meaning	Justified, true beliefs
Le Coadic (2004)	Information is knowledge recorded on a spatiotemporal support.	Knowledge is meaningful content assimilated for use.

According to Alavi and Leidner (1999), the concept of knowledge has its origin and use in the mind of people and circulated within organizations (Nonaka & Takeuchi, 1995), becoming integrated with internal process, norms and practices (Davenport & Prusak, 1998). Since Nonaka and Takeuchi's (1995) discussion of the distinction between explicit and tacit knowledge, which enforced Polanyi's (1966) discussion, researchers have tried to define KM.

Thus, this research paper relies upon the knowledge definition presented by Davenport and Prusak (1998), which considers knowledge as a "fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of the knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms".

Increasingly, companies will differentiate themselves on the basis of what they know, how they process information and how they collect the data. Several models have attempted to explore the issues of knowledge discovery, knowledge classification, knowledge acquisition, learning, pattern recognition, artificial intelligence algorithms, and decision support. In the last two decades, the Internet has shown its enormous potential as a tool for KM, revealing a new dimension that will be presented in the next section.

3. THE VIRTUAL KNOWLEDGE MANAGEMENT

Many claim that knowledge is a major factor driving business-level capabilities. Hence it is the most important source of competitive advantage (Nonaka & Takeuchi, 1995). Awad & Ghaziri (2004) stated that information and knowledge are critical to companies' performance. However, these authors suggested that capturing and transferring best practices is not enough to achieve success, especially in an Internet-based context.

The expansion of Internet and e-commerce technology allows firms to establish new forms of creation knowledge, and provides them opportunities to improve their capability to manage and use knowledge (Siau, 2000). Through the Internet, vast amounts of information concerning customers, suppliers, markets, and supply chains can be effortlessly gathered, while information about company processes, products, and services can be easily disseminated to the public.

Takahashi and Vandenbrink (2004) suggested that the problem facing top decision-makers in the ubiquitous information society will be how best to organize the knowledge cycle. One of the challenges is to share the knowledge with inside entities who value it, and to do so organizations must create and deploy knowledge management systems (KMS).

KM is one of the leading strategic areas being explored and adopted by companies (Schwartz et al., 2000; Grossman, 2006), especially by those who have invested in the Internet as a new channel and marketplace.

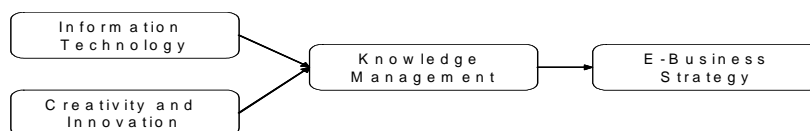


Figure 2. Knowledge Management Impact (Adapted from Malhotra, 2000)

According to Stojanovic and Handschuh (2002), the main function of a KM system is to capture and disseminate new sources of information. From this point of view, the Internet is a font of information. By using the Internet, companies implement a knowledge-acquisition and knowledge-sharing system, one that meets the requirements and specifications of unique and complex systems. It will match customer requirements to product characteristics (Ratchev et al., 2003) and allow the acquisition and maintaining of competitive advantages (See Figure 2). Furthermore, in this digital society, corporations need to adapt both knowledge management systems and business strategy in order to use digital information effectively and to take advantage of Internet possibilities (Takahashi & Vandenbrink, 2004).

Like many other information system implementations, KM is strongly linked in the literature to a sales and marketing perspective (Zhang & Zhao, 2006). For this research, we will consider KM as a combination of marketing tactics, knowledge-sharing, methods and technology. It can be used to gain and maintain

competitive advantages in a global marketplace such as the Internet and simultaneously cut down organizational layers.

As Malhotra (2000) suggested, the traditional KM model emphasizes convergence and compliance to achieved pre-specified organizational goals. On the other hand and according to several authors, virtual KM emerged from the Internet, and web technology facilities are used to implement KM solutions. Nevertheless, the concept of use of information technology as the key enabler of KM is not a new idea.

From the literature review performed, we consider virtual KM as an Internet-based business strategy integrating every area that touches the data gathering. These areas include sales and support services, the overall consideration of enhancing performance of people and processes with major contributions from new electronic technology (Internet, email, chat rooms, e-forums), and data transformation into information, i.e., extranet and other internal process and knowledge-sharing (intranet, extranet, LAN, WAN, VPN).

In this context, online companies are embracing knowledge management as a major element of corporate strategy. Online technological applications allow a rapid and low-cost access to data, faster and easier processing of the information and, above all, a greater level of knowledge sharing. However, the adoption of KM systems by online organisations implies a complex restructuring of all organisational elements and processes, in order to achieve the competitive advantages through the use of virtual KM systems. The virtual KM can be define has the incorporation of online technologies in the cycle of knowledge in order to enhance the KM processes.

The ubiquity era also gave another dimension to knowledge, decreasing the impact of several elements in the way firms use effectively knowledge, such as: size (Davenport & Prussak, 1998); industry; time and location. Through the presence online, any firm can achieve a global position and act in the global market, been the knowledge treatment a potential source of competitive advantages. Nevertheless, the application of KM in the traditional form is not enough to embrace all the challenges and opportunities that come along with Internet. Drawing from the literature on virtuality, we identified six discontinuities – geography, temporal, cultural, work practices, organization, and technology- that when fully applied to KM become the bases to the virtual KM. Thus, virtual KM can be considered as the convergence of a technology approach with a business value approach.

4. EVALUATION FRAMEWORK AND HYPOTHESES

The digital era bring with it enormous challenges that firms can embrace, especially if we consider the facility associated with the gathering of information about customers, suppliers, markets, and supply — and the easy processing of information about company processes, products, and services, which can also be easily spread to the public. Even though academic researchers and practitioners alike praise KM adoption (Schwartz et al., 2000), perhaps the most significant gap in the literature is the lack of large-scale empirical evidence showing that KM makes a difference to organizational performance — in particular at an Internet-based organization. The assumption underlying the use of virtual KM is that by locating and sharing useful knowledge, organizational performance will improve, particularly in the digital environments.

Following the literature reviewed in the previous section, we developed a research model (see Figure 2). It proposes virtual KM that will be positively associated with a set of intermediate outcomes that we call “KM practices”, and will be positively associated with online organizational performance. For that purpose we use a structural equation model with latent variables. This model consists of two sub-models: the measurement model and the structural equation model.

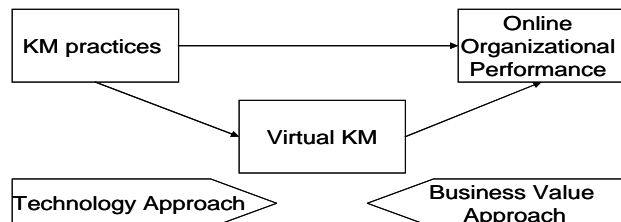


Figure 2. Research Model

The primary research questions to consider are these: What is the degree to which an organization engages virtual KM — in particular, technological KM practices — has a positive impact in online organizational performance? And is virtual KM, in turn, positively related to online organizational performance? Besides measuring the convergence of a technological approach with a business value approach, our aim is to discover the direct nature of the relationship between KM practices and online organizational performance.

The validation of the measurement model is done by using Confirmatory Factor Analysis (CFA). We will see later that the observable variables (indicators) we selected are measures of three latent variables (factors). We assume that these three KM practice factors each have a direct effect on the virtual KM and upon online corporation performance. Therefore, we assume that the online corporation performance is explained not only by the virtual KM, but also by a general KM practices factor that is concerned with the gathering of data, information process and knowledge-sharing.

Therefore, it is postulated that the considered indicators measure three different and positively correlated latent variables or factors (hypothesis H1). Each factor is supposed to contribute directly to the determination of the online corporation's performance (hypotheses H2 and H3). Besides these direct effects, it is also assumed that there is an indirect effect via virtual KM (H4). In sum, the four research hypotheses are the following:

H1: The indicators considered define three positively correlated factors;

H2: The KM practices factor positively and significantly determines the online corporation performance;

H3: The factor concerned with KM practices positively and significantly determines the virtual KM;

H4: The KM practices factor positively and significantly leads online corporation performance through virtual KM application.

Awad and Ghaziri (2004) pointed out that KM awareness benefits the entire organization and that it relies on developing a KM environment inside and outside the firm — one that permits a generation of new knowledge, i.e. the transfer of existing knowledge and its application to new products, services and process. Davenport and Prussak (1998) considers that KM focuses on processes and mechanisms for locating and sharing knowledge possessed by an organization or its external stakeholders. Based on this, we define KM practices as the group of technological efforts carried out by the organization in three different dimensions: data gathering, information process and knowledge-sharing. In total, we identified twelve KM practices. Each has been suggested elsewhere as being important for effective virtual KM (Gold et al, 2001; Malhotra, 2000; Awad and Ghaziri, 2004; Schwartz et al., 2000; McKeen et al, 2005; Tiago et al, 2007; among others).

In Internet-based practices, most traditional financial and accounting methods of evaluation are not suitable as the only forms of performance measurement. This is due to the fact that there are some intangible, indirect and even strategic benefits that need to be considered (Grembergen & Amelinckx, 2002). From the literature review, it is found that KM has been linked positively to non-financial performance measures such as quality (Mukherjee et al., 1998; McKeen et. al, 2005; Tiago et al., 2007), innovation (Francisco & Guadamillas, 2002), productivity (Lapre & Wassenhove, 2001), and sales (Tiago et al., 2007). In fact, the expected results are that KM simultaneously influences many different aspects of organizational performance. The work of Gold et al. (2001) presents a combination of two dimensions as enablers of effective performance improvements: knowledge infrastructure and knowledge-processing capacity. Other frameworks have been presented, but the specific interface between virtual KM and e-business has not been addressed from the organisational point of view. So we will follow in the last authors' steps, using as performance measures elements of both infrastructure and processing dimensions.

In identifying KM practices as antecedents to virtual KM and online organizational performance, we attempted to include factors that have been previously tested by others authors (see for example, Gold et al., 2001).

5. METHODOLOGY AND RESULTS

The data used to test our research model comes from the e-Business W@tch annual survey (2005). This data was collected in a large survey about e-business in European enterprises. Considering that this study examines the status of adaptation of virtual KM by companies, the original sample was limited to firms having e-business activities and companies adopting KM practices. So, our work sample of 5.216 cases

constitutes a heterogeneous sample of companies in terms of industries, fields, size, business model and country. The data covers 7 European countries (Czech Republic, France, Germany, Italy, Poland, Spain and the U.K.). Distribution of firm size, measured by the number of employees, shows that almost half of the firms are micro- and small-size firms (around 50.7%). The industry distribution of the responding sample is approximately similar to the original sample. The two less heavily represented sectors in the sample are the aerospace industry and manufacture of pharmaceuticals, with 3.1% and 10.2% respectively, closely followed by all the others.

The model was estimated by the Maximum Likelihood method in the AMOS package. The model goodness of fit may be considered acceptable according to the values of some goodness-of-fit index, although the chi-square test statistic ($\chi^2 = 626,4$; $df = 117$; $p\text{-value} = 0,000$) is significant, implying a bad fit. However, as is well known, this test has serious limitations — namely its dependence on the sample size and on the number of indicators. In general, for large sample sizes the chi-square statistic is significant, and in the present case the sample size is very large ($n = 5,216$). For that reason, it is usual to evaluate the goodness of the fit by a set of index, also presented in Figure 3.

After global model fit has been assessed, the numerical results were evaluated in order to test their support of the research question. The numerical results can be obtained directly from the path coefficients of the structural model presented in Figure 3. We refer to standardised coefficients that account for scale effects and serve as indicators of the relative importance of the variables.

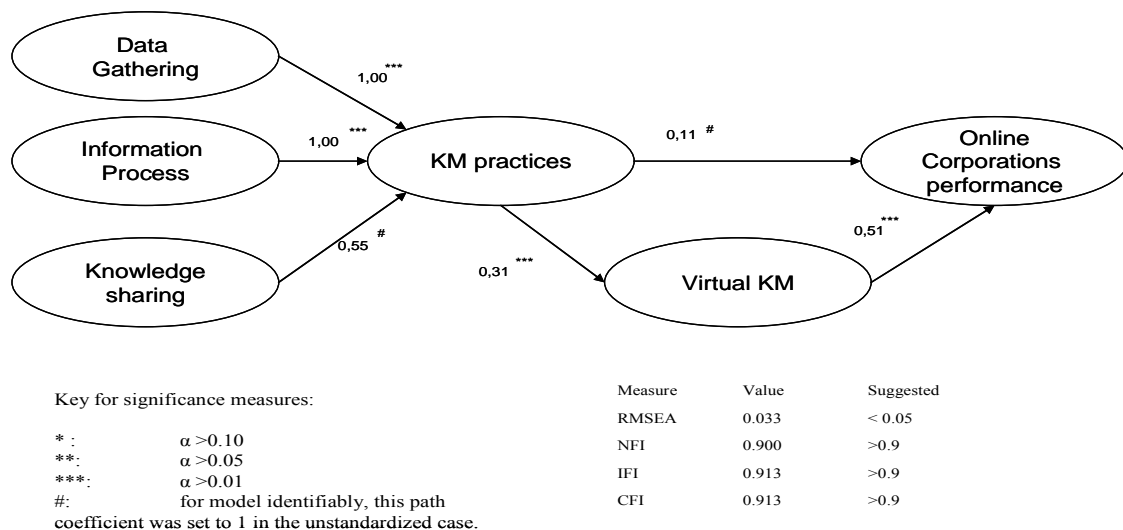


Figure 3. Structural equation model and estimation results

The measures for global model fit included in Figure 3 suggest that our model fits the underlying data well. All the paths were statistically significant.

The three dimensions used to compose the KM practices are all significant and highly correlated to the KM practices construct. As a result, hypothesis H1 is not rejected. Nevertheless, a reference needs to be made regarding the relative lower value achieved in terms of knowledge-sharing.

The results show that KM practices competencies explain only 11 percent of the variance in online corporations' performance, in accordance with Hair et al. (1998). Thus, this finding gives no empirical support to the concept that online performance can be improved by the use of the three basic components of KM traditional practices: data gathering; information process and knowledge-sharing. With this consideration in mind, hypothesis H2 is rejected.

The results also show that virtual KM explains 51 percent of an online corporation's performance, implying that our hypothesis H3 is not rejected.

The data gathering, information processing and knowledge-sharing combined are not significantly important for the direct determination of an online corporation's performance. However, these items have an indirect effect on the performance via their positive influence on the virtual KM. So, hypothesis H4 is not rejected.

KM practices and virtual KM are only part of the equation; the construct of online corporation performance must also be measured. All of the non-financial factors used show a positive and significant relationship. This provides empirical support for the theoretical views that state that online performance needs to be measured using new criteria, and not exclusively finance-based criteria.

6. DISCUSSION AND CONCLUSIONS

Knowledge Management has presented several difficulties in the traditional IT environment, basically related to the constrained form of sharing the knowledge. In the present ubiquitous information context, KM seems to be an easier and promising tool, especially when used in its global version. As the literature review showed, there have been only a few works examining KM practices and virtual KM contributions to online performance from a corporate perspective. Moreover, the majority of these works were confined to specific industries and confined to small data samples. The goal of the current study was therefore to answer the following questions: What is the degree to which an organization engages virtual KM — in particular, technological KM practices — has a positive impact in online organizational performance? And is virtual KM, in turn, positively related to online organizational performance? With this study, we attempt to contribute to bridging the existing research gaps. We do so by presenting results from an empirical investigation based on a cross-industry survey, which covers seven European countries.

The findings shown above, as reported by respondents in the case companies, demonstrate the kinds of applications they really need or value, how KM practices are used and valued, and the ways in which virtual KM can help to achieve higher levels of online performance, considering a new set of non-financials measurements.

Considering the results, we can find evidence to confirm most of the hypotheses that we formulated regarding the impact of virtual KM in online corporations' performance. First, the data supports our conceptualisation for the KM practices construct: data gathering, information process and knowledge-sharing. Within this, all elements have a positive impact on the maximisation of KM practices.

Secondly, the findings allow us to conclude that virtual KM has a positive impact on online performance, which was expected considering the existing literature on this matter.

There is no evidence of a threshold effect between the three KM practices components and online performance, something that has not been noted previously.

According to these results, the concept of virtual KM as an important e-business tool is reinforced. Thus, the relationship between virtual KM and online performance follows the positive relationship found in some earlier studies. One of the managerial contributions of this work is the discovery that managers should consider the use of virtual KM to improve everyday online processes — and should also be aware that the simple use of the KM practices is not enough to achieved higher performance levels. However, a cost-benefit analysis should be made to assess the return on the investments made in KM, since we only considered the upside of this initiative. Until KM becomes an ingrained and standard tool of e-business, the need to define measurement criteria will continue in order to support the corporate implementation and maintenance of such systems.

Further work is clearly needed to examine the interaction between virtual KM and online performance over time or in small sets of the sample. Doing so would allow us to find out if the relationship is equally strong in all countries and which contextual factors affect this relationship.

This research produces some useful insights, leaving still a number of issues for future research. One of these issues is related to the possibility of extending the study in order to consider the impact of other elements of virtual KM, such as technological readiness and management support. Similarly, this study could be expanded through the application of a panel data methodology that would determine the evolution of virtual KM contribution to online performance among European companies.

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AN EXAMINATION OF THE MATURITY LEVEL OF THE INDIAN E-GOVERNMENT PORTAL

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ABSTRACT

The aim of this qualitative study is to examine the Indian government portal, and gauge its maturity level. The paper first provides a brief background to the Indian e-government vision. Then, the paper reviews an e-government maturity framework which is used to guide data collection and analysis followed by results presentation and discussion. Finally, the paper concludes by revealing the Indian e-government portal maturity level and providing direction for future research.

KEYWORDS

E-government, Maturity Level, Qualitative, India, ICT

1. BACKGROUND OF E-GOVERNMENT

Many governments around the world are increasingly using internet technologies to provide various public services. These services range from providing the most basic informational website to deploying sophisticated tools for managing interactions within government agencies and beyond. This has resulted in the development of many electronic government (e-government) initiatives that aim to enhance the delivery of government services to citizens and improve interactions with businesses and industry.

The World Bank reports that e-government initiatives have the potential to transform government relations with citizens, businesses, and other arms of government (World Bank, 2006). It is believed that e-government has the potential to transform the fundamental relationship between government and citizen by encouraging citizen participation in the political process (Gupta and Jana, 2003; World Bank, 2006).

Furthermore, e-government initiatives have the potential not only to transform the relationship between government and citizen, but also between government and business. E-government initiatives can enhance service delivery to businesses in many ways. For example, it can improve business registration and license application, inspection clearance, customs modernization, tax administration and procurement of goods and services... etc. However, West (2004) argues that e-government initiatives have fallen short of their potential to transform service delivery and improve public trust in government.

2. OVERVIEW OF THE INDIAN E-GOVERNMENT VISION

India, a union of states, is a sovereign, secular, and democratic republic with a parliamentary system of Government. There are 28 states and 7 Union Territories (UT) in the country. From the largest to the smallest, each state/UT of India has a unique demography, history and culture, language etc. The Indian e-government portal developed by the National Informatics Centre (NIC) to provide a single window access to the information and services provided by the Indian Government for citizens and other stakeholders (see www.india.gov.in)

In 2006 the Indian government revealed its e-government vision that aims at making:

“all Government services accessible to the common man in his locality, through common service delivery outlets and ensure efficiency, transparency & reliability of such services at affordable costs to realize the basic needs of the common man” (Indian Government, 2007, p.14).

The government of India set plans to use ICT (Information and Communication Technologies) in all its departments to enhance the government service to citizens and businesses. On May 18, 2006, the Government of India approved the National e-Governance Plan (NeGP) which is an on going project that has 27 Mission Mode Projects (MMPs) and 10 components that leads to the implementation of the government e-government vision (see www.india.gov.in for details on NeGP objectives and components).

3. E-GOVERNMENT MATURITY FRAMEWORK

Increasingly, more developing countries are initiating e-government projects to reap the benefits of using ICTs in the public sector. To ensure that these benefits are realized, it's important to constantly monitor and measure the maturity level of e-government projects. Windley (2002) defines Maturity Models as “a method for judging the maturity of the processes of an organization” (p. 1). Windley proposes a four level E-government Maturity Model that can be used to guide the development and maintenance of e-government services. Windley's model contributed to the theoretical framework of this study and informed the design of the observational form used to collect data. Also, the framework provided a structure for data analysis. The following section describes the model, shown in Table 1, which consists of a number of attributes that show four sequential levels of e-government maturity, the four levels are described below.

Table 1. E -Government Maturity Model

	<i>Level 1: Simple Website</i>	<i>Level 2: Online Government</i>	<i>Level 3: Integrated Government</i>	<i>Level 4: Transformed Government</i>
Attributes	<ul style="list-style-type: none"> - Static pages - Lists of departments and contact information - Links to separate departments - Policy statements - Downloadable forms and documents - Access primarily via telephone - No site reporting, tracking or analysis 	<ul style="list-style-type: none"> - Departmental focus - Online forms for applications and registrations - Online payment - Request information or service via email - Respond to online surveys - Limited online help, FAQs, resolution services - Basic account inquiry - Basic benefits enrollment 	<ul style="list-style-type: none"> - End-to-end electronic transactions - Automated RFP and procurement process - Cross-departmental sharing of information - Automated advice and problem resolution data - Limited configuration capabilities - Self-service HR administration - Web-based training 	<ul style="list-style-type: none"> - Community-centric, integrated, intergovernmental processes - Common platform for targeting content through any channel/touch point - Internal/external business process integration and collaboration (planning, workflow, design) - Constituent case tracking to ensure resolution and satisfaction - Highly configurable HR (benefits, career planning, development training)

Source: Windley (2002)

The first level of the maturity model is called simple website: at this level e-government portals are made of simple, predominantly static website for a single government department or division with few downloadable forms and some contact details and phone numbers. Typically, level 1 represents a start that many new e-government initiatives go through. However, there is, change in the traditional government to citizen or business relationships.

The second level is called online government; at this level static websites are replaced with dynamic website that enables government customers (individuals and businesses) to interact with government departments electronically. For example, customers can send emails, pay for services online, get answers for

FAQs ...etc. using dynamic websites enables government departments to elicit information from their clients and provide them with the feedback they require.

Building an integrated government website is the third level of the maturity model. The aim of building an integrated government website is to deliver end-to-end electronic transactions that bring multiple processes together in a meaningful way. To reach this level, e-government initiatives are not only required to build sophisticated, high-tech websites but also governments need to integrate and streamline back-office processes and systems.

The fourth level in the maturity model is called transformed government. This level is reached when e-government processes are operating in ways that change the nature of how government works leading to reformed public services.

The ultimate goal of e-government portal is to realize the concept of 'One Stop Shop' that many developed and developing countries aim to reach the transformed government level. A study conducted by Anderson Consulting in 2006 concluded that there are vast differences among countries in the maturity level of their e-government initiatives (Andersen, 2006).

4. RESEARCH DESIGN

4.1 Aim

This qualitative study investigates the maturity level of the Indian government portal. The study objectives were to: (1) Examine the Indian government portal (2) gauge the maturity level of the portal.

4.2 Method and Data Collection

The study used qualitative approach to collect data from the Indian government portal. A structured observational method (Mintzberg, 1973) used to collect data from the portal. A team of two researchers collected data by observing the portal and recording their observations using a predesigned data collection form. The observation form design was informed by Windley (2002) e-government maturity model attributes described above. The researchers examined the different functionalities of the Indian e-government portal to determine its maturity level.

The data was collected over a period of six month in two rounds. In each round, both researchers visit the portal independently and recorded their observation about the different portal functionality according to the criteria specified in the observation form. The recorded observations was then compared and conciliated in one form. In the event of any differences in the individual researcher observation form, a third visit to the portal was done to resolve the difference. The data collected were organized into four categories (Simple website, moving towards online government, an integrated government, the ultimate goal 'transformed government'); these categories were informed by Windley's (2002) e-government maturity model.

5. ANALYSIS, RESULTS AND DISCUSSION

According to the Ministry of Law and Justice (2005), the Indian e-government portal has been developed to provide "a single window access to" information supplied by various government entities for citizens, businesses and overseas personnel. The portal has links to a number of ministries and departments under the jurisdiction of the central and state governments.

The portal has a combination of both static and dynamic web pages. The results shown in Table 2 indicate that the portal can be classified as "Online Government" because it meet the majority of the required functionality for this level according the E-Government Maturity Level described earlier. The Indian portal provides a list of contact details for each government department. Furthermore, almost all government departments, both central and states, provide downloadable forms and documents. Policy statements and process are also included in the departmental sites. Having such functionality in the portal satisfies the required attributes for the site to be at level 1 of the Windley's e-Government maturity model.

Table 2. Observation form – Functionalities Required for Level 1 and 2 Maturity

CRITERIA	YES	NO	PARTIAL	COMMENTS
Simple website				
Site has a combination of static and dynamic WebPages	√			
Departments Contact Information available from the website	√			
The portal has individual department pages	√			
Links to other department WebPages available	√			
E-government Policy Statements present	√			
Forms and other documents available for download	√			
Tracking and reporting facilities	√			
Moving towards online government				
The portal has departmental focus	√			The portal has links to various government department, however individual department WebPages are mainly informational WebPages (i.e. lack of online transaction facilities).
Online forms for applications and registrations available			√	Only Income Tax Department has this facility.
Online payment facilities in each department		√		
Facility available to request service over email			√	Limited number of departments has email facilities for feedback purposes.
Portal users can respond to online surveys.		√		No evidence of online surveys.
FAQ's related to each department	√			Different departments have FAQ section on how to avail various services (e.g. applying for birth certificate, obtaining business license ...etc).
Online help facilities available for each department		√		Not for each department.
Citizens and business are able to create and maintain online account		√		
Benefits for members to encourage the use of the e government service.		√		

At the time of writing, the majority of government agencies provide online help, FAQ and answers for basic inquiry via email. Only few departments allow users to complete forms and online transactions. For example, the Income Tax Department allows users to file Income Tax Return, track income tax related applications, sales tax, central excise...etc., using online facilities. The majority of departments provide downloadable forms for users; however, the forms must be completed manually and submitted using conventional methods (see Table 2).

The data presented in Table 3 show that the portal lacks almost all level 3 and 4 required attributes. For example, the portal has no online payment facilities, no services related to payment (i.e. basic account inquiry ...etc), and online surveys to collect feedback on users experience with the online e-government services. However, some of the functionalities were partially available. For example few department websites have very limited help facility that aid the users when completing a transaction e.g. the Income Tax Department. Limited search facilities were found that allows users to give their opinion on the portal design, and provide suggestions for further improvement.

Table 3. Observation Form – Functionalities Required for Level 3 and 4 Maturity

CRITERIA	YES	NO	PARTIAL	COMMENTS
An integrated government				
Entire transaction is online		√		Partial transaction on income tax department is online, rest of the department transactions are not online.
Sharing of information across various departments			√	Few departments share the information across the department
Automated help services to the users in case they face any problem		√		
Training facilities available for the new users		√		
Help files available to help the new users on how to use the system			√	Help files are available for some transactions in the form of FAQs.
Search facility to locate the information or service that we are looking for			√	Only site map is available.
User friendly interface with limited configuration facility		√		
Self service administration page		√		
Web-based training		√		
The ultimate goal: transformed government				
Departmental services are integrated based on the need of the user community with intergovernmental process		√		No evidence of process integrations found.
Common platform for targeting content through any channel/touch point		√		
Integrated with the internal and external business partners to enhance the service		√		
Initiative taken to know the satisfaction level of the user		√		
Highly configurable facilities available in the site.		√		
Facilities available in the site to add or remove more functions		√		
Facilities available for the user to configure his member page and add services that he is in need		√		

The 2006-2007 Annual Report published by the Information Technology Department, which handles the e-government project, states that cross-departmental sharing of information standards and draft policies has been formulated. However, the implementation of information sharing across different departments has not yet been realized. Furthermore, there is no evidence of self-service HR administration, automated RFP, web-based training, and configuration capabilities found in the portal. Given the above data presented in Table 3, it's clear that portal can't be classified as an "Integrated Government" because many attributes listed in the Windley's model are not satisfied. Also, the portal has not reached the "Transformed Government" level because the portal lacks the functionalities required by Windley's model to be classified at this level of maturity. For example, there is no integration and information sharing across different government departments, no common platform for targeting content through multiple channels, no integration and collaboration of Internal/external business processes ...etc.

Based on the above discussion, we argue that the Indian e-government portal maturity level is already beyond the "Simple Website" level. The portal can be classified as moving towards an "Online Government". However, the portal at this stage can't be fully classified as "Online Government". This is because the majority of the attributes required by the Windley's model to reach this level (availability of online payment facilities in each department, ability of respond to online surveys, ability of users to create and maintain online account ...etc) has not been satisfied. In addition, some of the attributes required for this

level are partially available, for example online application forms and requesting services over email are available on some government department websites.

6. CONCLUSION

The aim of this paper is to analyze the Indian e-government portal and classify the portal's maturity based on the E -Government Maturity Model suggested by Windley (2002). The results of the analysis suggest that the Indian e-government portal has passed the "Simple Website" level and moving towards an "Online Government" maturity level. The findings also indicate that the portal has not reached the "Integrated Government" and the "Transformed Government" maturity level yet. This implies that the Indian government is yet to realize the full potential of its e-government initiative. Perhaps India is not the only country that did not reap the full benefits from e-government projects. This finding is in line with Andersen's (2006) findings which state that even the most mature countries have tapped less than 20% of the potential of e-government.

We found Windley's E-Government Maturity Model to be useful not only because it gives structure to our portal observation but also for the clear functionality indicators that enable researchers to gauge portal maturity. Further, the model provides milestones that can aid government strategic planners to aim at achieving higher maturity levels. Further studies are needed to investigate how the Indian government can reach higher maturity level to reach and moving beyond the "Online Government" towards becoming a "Transformed Government".

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E-GOVERNMENT QUALITY OF SERVICE: THE ROLE OF CITIZENS

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ABSTRACT

Quality of Service assessment is a complex and a fundamental task in e-government. In such domain citizens their experiences and contexts are critical aspects to assess carefully quality. In particular, citizens' socio-democratic characteristics, cultural levels and government aware impact on the assessment with different weights. In this article we report on early and preliminary results from citizens based quality investigation. It is a part of a more general research on e-government quality where we focus on a suitable assessment methodology. We discuss an approach based on two questionnaires. The first one validates the goodness of our quality model and the second one supports the measurement of subjective quality parameters. The approach impacts on the first and second phases of our methodology. Results support future integration in a quality driven e-government services development where services adaptation plays a fundamental role.

KEYWORDS

Quality, e-Government, Services, Citizens.

1. INTRODUCTION

e-Government is a complex and dynamic domain characterized by citizens, services, ICT and organizational aspects. More in general we observe internal, external and technological views of e-government [16]. In such context quality of service is recognized as a critical aspect, there are a lot of service characteristics to consider and the citizens must be properly investigated. e-Government seems now mature enough in low interaction services delivery [3]. Nowadays, most of the Public Administrations provide only information or one-way services. Significant government benefits and a high level of citizens satisfaction are obtained when a Public Administration (PA) also offers all the interaction levels of services.

Different models focus on e-government maturity [9] [4] [11], some of them underline technological infrastructure, some other recognize human capital and governance. We focus on e-government services development [18]. In such context, the literature reports different levels of e-government maturity (cataloguing, transaction, vertical and horizontal integrations). They are implemented through a growing model that supports e-government diffusion [2]. In particular, for each maturity level, some relevant factors were identified to assess e-government success (i.e. flexibility, cost reduction, service externalization, ...) [3]. In our opinion, overall quality of service supports e-government diffusion and maturity. It gives a boost to the citizens e-government acceptance introducing appropriate government aware.

About quality, we refer to the following definition. "All the features of digital services in Public Administrations that influence their capabilities to satisfy declared or implied user's needs" [7]. It refers on two group of parameters, they are related to subjectivity and objectivity. The former is conditioned by individuals experience or knowledge and by personal mental characteristics or states. Such parameters are related to the e-government users and their feeling on the services and IT context. On the other hand objective parameters are deeply link to the service implementation (usually web service [1]). Objective parameters measurement is individual independent, but in our opinion users define their relevance and validity in e-government environment.

In this article we report on early and preliminary results from citizens based quality investigation. We focus on the role of citizens to analyze the quality of services in e-government. We discuss the firsts results

on the citizens' impact in the quality definition. It is a part of a more general research on e-government quality where we focus on a suitable methodology for assessment based on a quality model presented in [8].

In this paper, we propose an approach based on two questionnaires to formalize citizens impact on the quality. The first is used to validate quality model's goodness. It addresses interesting results about the citizens support in quality definition. Feedbacks show explicit and implicit relationships among quality parameters, service components and users needs. The second questionnaire is introduced to assess the subjective component of quality of services. Its results compete to the quality of service assessment. The approach impacts on the first and second phases of our methodology.

Interesting researches support our study, particularly for what concern quality of web site [12] [10] [15] [19] [20] [17]. Other approaches introduce a gap model between citizens expectation and services requirements focusing on traditional government services or organization aspects [6][13]. At the same time different efforts are discussed in web service domain (this is the typical e-government service implementation) [14]. As far as we know this is the first attempt to put together different e-government views on quality. In particular, the citizens, their expectations and PAs communication capabilities will be properly managed within a technological framework that supports e-service implementation in e-government.

The rest of the paper is organized as follows. Section 2 presents a quality overview. Section 3 introduces the first results of questionnaires describing the users impact on the quality model definition. Finally, in Section 4 conclusions are yielded and some future works are drawing.

2. QUALITY OVERVIEW

In this section we refer to the role of the citizens and their possible impact on the quality and we propose a general view on the quality in e-government.

2.1 Citizens Impact

As previously said, e-government service quality is deeply link to citizens and their experiences and contexts. It considers heterogeneous and subjective components. In our opinion users and their satisfaction must be properly introduced to assess carefully quality. We analyze a sample group of people to assess the quality of service in e-government. In this first stage of our research we choose 140 people, most of them are skilled in e-government domain. We define sample groups of citizens and for each group we study their perception of quality. The groups rely on the following characteristics: social-demographic, cultural levels, geographic localization and e-government awareness. Social-demographic characteristics include age, sex, profession, marital status and annual income. At cultural levels we distinguish "Curriculum Studiorum". The classification based on geographic localization depends on the nationality, region or province of citizens. e-Government awareness refers to the importance given to Public Administration by citizens and at the same time to the e-government service. Of course, there are other possible groups of users, which can be based on common characteristics. After group definition we understand relationships with quality parameters. At the same time, we focus on how much the quality parameters are basically for a particular group of citizens.

Moreover, for each group of people their perception about quality and parameters depend on e-government service expectations. In such context, the continuous monitoring on the quality supports dynamic observation of the reality observing the impact of citizens experience on service. A particular role is played by PAs' communication capabilities. PA makes use of explicit advertises, they are useful to impact citizens expectations. Advertise should includes tacit elements related to service aspect and reputation. In line with users' expectations and PAs communication capabilities we weight parameters, metrics and measurements (Figure 1).

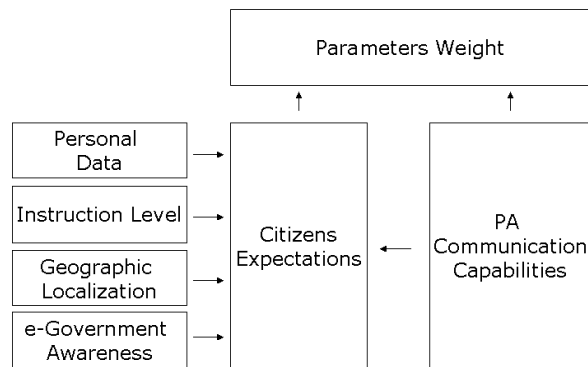


Figure 1. Citizens Impact on e-Government Services.

2.2 Quality Views

In this section, we discuss briefly different view on the quality and we report our methodology focusing on quality definition and measurement. In particular, please refer to [8] for a more complete discussion on the methodology.

Quality of service is a complex topic related to the different aspects that impact on the service in use. We refer to the following interacting aspect (Figure 2)

- Citizens' satisfaction addressing the overall level of quality expected (before the use) and perceived (after the use) by the citizens.
- Technology quality refers to site quality (interface quality) addressing the factors of the site usability, and interface and back-end performance layer addressing the factors of the technical performance related to the service implementation (usually via web service technology) and related supporting infrastructure.
- External Quality refers to the quality of other substitutive service. The low of the market is not so important in e-government as in e-business, but substitutive service (if existing) has to be taken into account to assess the overall quality.
- Quality of Delivery Process in Organization refer to the importance of the delivery as a complex process into the PA that distribute the service. Each administration/s that take part to the delivery process has to be consider in line with it internal organizational structure, its knowledge and data and the resource available in term of information technology.

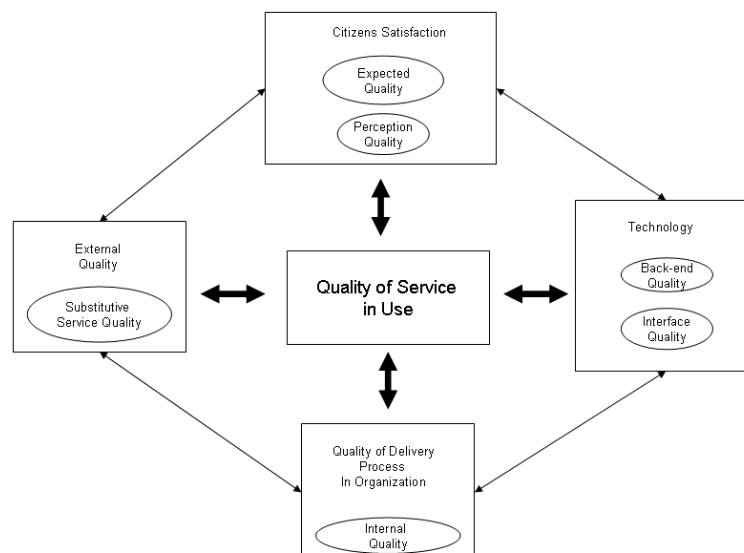


Figure 2. Quality Views.

The methodology relies on the following activities: (i) development of a quality vocabulary, (ii) formalization of the measurements and (iii) definition of a quality aggregation function. In particular, the first phase refers to the identification of parameters and related metrics starting from a review of the e-government domain. The second one supports the measurement process (questionnaires and run time measurement). The last one introduces a mathematical model to define a quality function and assess a quality value starting from the sets of detected parameters [7]. In this paper we consider the following items to introduce citizens impact on quality definition, measurement and assessment (Figure 3). They are related to the first and the second steps of our methodology.

1. Macro-areas specification.
2. Parameters identification (for each macro-area and service level).
3. Parameters weighted (starting from a questionnaire submitted to citizens). It guarantees a validation and verification of the item 2.
4. Measurement questionnaires starting from the results of item 3.
5. Characterization of the measurement questionnaires results focusing on the services level.

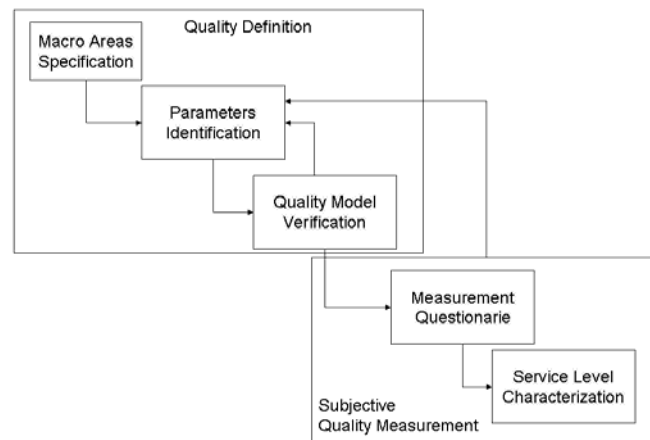


Figure 3. Quality methodology: Steps of the Proposed Approach.

2.3 Quality Definition: Technology View

About quality definition we specified macro-areas and parameters (item 1 - 2). In particular, we refer to (i) *e-government parameters* that take into account how the interface of digital services of Public Administrations are perceived by the final users (popularity, usability, attraction, multicanality, internationalization, reputation, originality, contents, legality, trust, promoting e-democracy, completeness), (ii) *presentation parameters* that analyze front-office services with respect to the final users needs, they are domain independent (cost, accessibility and adaptability), (iii) *behavioral parameters* that describe the implementation of back-office services (interoperability, supported standard/regulatory, applicative security and robustness/flexibility), and (iv) *infrastructural parameters* related to the basic infrastructures enabling digital services (availability, performance, scalability, scheduling, throughput and reliability).

Focusing on macro-areas and parameters we develop the first questionnaire (item 3). It is useful to validate the goodness of our model. The forty-four questions proposed to the citizens are following proposed. The questions (1-5) refer to the interviewee personal information (i.e. gender, nationality, age, instruction level, occupation, geographic localization, etc.). The questions (6-12) introduce information related to interviewees cultural level and e-government awareness. These questions are also used to mark the questionnaire measuring the goodness and the reliability of the answers. The questions (13-17) support a first definition of the macro-area weight starting from the percentages specified by the user to implement the impact of the specific parameters on quality. They are able to introduce users expectations and define the PAs communication capability observed by the user. The questions (18-42) are used to really validate the considered parameters and metrics. The questions (43-44) ask about the completeness of the proposed quality approach.

2.4 Quality Measurement

For what concern the measurements (item 4) we consider different service levels and we introduce a further questionnaire based on the parameters. This questionnaire starts from the results of item 3. It supports a continue monitoring on the e-government services guaranteeing the auto management of digital PA. The value of the service parameters are computed using the average ranking given to the service by the end users after service use. We considering the proper ranks given to the service parameters by the users related to the number of time that the service has been graded in a reasonable time interval. Questionnaires are anonymous and properly managed through an open source tool.

3. USERS IMPACT ON QUALITY DEFINITION

In this section we refer to those parameters and metrics that are recognized valid from the citizens. Related to the interviewees we report the following results. 83,3% of them are man and 16,7% are woman. Related to the age: 59% are less than 30 years old, 37,9% are between 31 and 45 years old, and 3,1% are more than 45 years old. Focusing on the instruction levels: 45% of the interview have primary and secondary school certification, meanwhile 55% have an university degree. Our interviews are: students 43,9%, public employee 34,8%, and firms employee 21,3%. About e-government aware: 95,4% of the interviews know e-government, meanwhile 4,6% of them do not know it. About the 95,4% of users that know e-government 43,9% have already used its e-services, meanwhile 56,06% didn't use them. Related to the ICT experience: 60,6% are users with low experience, 28,78% are with a medium level, and 10,61% have an height level skills. Focusing on the people with experience we ask about their opinion on the introduction of adapted services: 54,54% of them agree, and 45,46% disagree. In particular, only 4,5% of interviews are prone to distribute personal information.

About macro-area specification we refer to Table 1 and 2. Table 1 introduces the classification observing citizens ICT expertise. We observe an importance role of e-government parameters for little and medium users experience. At the same time users with high ICT experience give more importance to front-end, back-office and infrastructural parameters. Table 2 focuses on the distribution of macro-areas importance in relation to users age. We observe that front-end parameters are relevant for people with less of 30 years old and back-office parameters are relevant for people between 30 and 45 years old. At least, people with more than 45 years old focus on back-office parameters. The values presented in the table can be properly managed and aggregated to support the assessment of the overall quality of service. They represents one of the inputs of the mathematical model discussed in [7].

Following we propose the more significant parameters that are validated thought questionnaires their metrics and related weights. The weights are expressed in percentage related to the users ranking. The measured are relative to forty-four questions. We planned to extend them in the next feature.

Table 1. Macro-Areas weight based on the users ICT expertise.

Users Experience	e-Gov	Front-End	Back-office	Infrastructural
Low	39 %	19 %	23 %	19 %
Medium	33 %	28 %	22 %	17 %
High	19 %	38 %	22 %	21 %

Table 2. Macro-Areas weight based on the users age.

Users Age	e-Gov	Front-End	Back-office	Infrastructural
Less than 30	19 %	40 %	22 %	19 %
Between 30 and 45	22 %	19 %	23 %	36 %
More than 45	18 %	19 %	42 %	21 %

Popularity is the service's capability of being widely admired or accepted. It is measured considers (i) the amount of population interested to the service (34,55%) as well as the (ii) utilization frequency respect to time and number of interactions government-users (63,64%).

Usability considers the easiness of learning the service and benefit of its information. It is measured focusing on the following indicators. Understandability is the measure of how readily the users perceive information significance and service behaviour (89,66%). Learnability is the measure of information and service level to support the user's ability to correctly use the service and to read the information with and without instructions (50%). Compliance represents the level of service and information to introduce an harmonious environment where the behaviour and the actions are predictable (67,8%). Attractiveness is the measure of the service ability to attract users (91,5%). It measures the users' incentive to use on-line services rather than traditional one (offered by Public Administrations through off-line channels).

Originality focuses on the service innovation level. It is measured considering the capabilities of (i) actively absorb technology, especially information technology, and strive to build e-government (46,8%), (ii) adapt to the market economy of public management methods, focus on planning, use of the macro, indirect management methods, and enhance coordination (61,9%), and (iii) implement innovative projects to introduce full theoretical research (19,6%).

Content indicates Public Administrations capabilities to provide useful and proper information. It is measured focusing on the following indicators: (i) information appropriateness (50,8%), (ii) information updating (76%), and (iii) information completeness (97,3%).

Domain Security that measures the process and information control level. It is measured focusing on (i) the service and information adherence to law and regulation in relation to the communication standard (78%), and (ii) adherence to law and regulation during the service delivery (68%).

Legality represents the importance of laws and norms capabilities that regulate the provision and fruition of services (52%).

Trust represents the level of confidence among stakeholders in the services execution. This parameter involves citizens, enterprises, Public Administration employees, software agents and organizations focusing the attention on proper skills and tasks. At the same time a digital service underlines privacy and communication security levels. A proper service distribution allows a certain level of trust and promotes the service utilization. It is measured focusing on identity related risks and trust. About identity related risk we refer to (i) interception or revelation of secret authentication information (68%), (ii) retention of secret authentication information in un-trusted terminal (67%), (iii) use of compromised credential (78%), and (iv) use of credential after substantive change in circumstances (69%). On the other hand focusing on trust we also consider service reputation. It represents the service trustworthiness (69,78%). Trustworthiness is a moral value considered to be a virtue. A trustworthy Public Administration is an organization in whom we can place our trust and rest assured that the trust will not be betrayed. A Public Administration proves his trustworthiness by fulfilling its tasks.

Promoting e-Democracy represents the impact of a service on the society showing how a service promotes digital citizenship. Namely, the set of ICT practices available for the citizens to take part to political choices at any level. It is measured considering the presence of FAQ (78%), mailing list (45%), newsletter (19%), forum (97%), and chat (89%).

Cost measures the mean amount of money involved in a complete service transaction, capturing the economic condition of the service use. It is measured considering every cost related to the service provision such as execution price (25,6%), and extra money request for service delivery (88,2%).

Accessibility measures the users' easiness to detect and to use the needed service capabilities. It is particularly relevant related to disadvantaged people. It is measured focusing front end site related to (i) javascript introductions (17%), (ii) video resolution (88%), (iii) browsing independence (96%), (iv) on-line help presence (68%), and (v) voice support (94,8%).

Adaptability evaluate the service capabilities to change and make itself suitable for a new environment. It is measured focusing on a mapping among service functionalities and the following items (i) base information on users (98,78%) (ii) information on the users context (57,8%), and (iii) device used to access the service (78,9%).

Interoperability represents the amount of cooperative work among citizens applications, software agents and services in different administrations or agencies. From this perspective, the use of standards affects services interoperability. It is measured focusing on (i) supported standard (77,98%), (ii) organizational interoperability (67,6%), (iii) semantic interoperability (68,7%), and (iv) technical interoperability (95%).

Applicative Security represents the security level of services introducing authentication and authorization policies and procedures. It is measured focusing on (i) presence of different authentication

ways (using username and password and/or smart card) (88,9%), and (ii) definition of authorization policies and procedures with different accuracy level (76%).

Integrity, about transactions and related data, is another important element. It measures service ability to prevent unauthorized access to - or modification of - computer programs or data. It remarks the ACID properties: atomicity, consistency, isolation and durability. It is measured focusing on the presence of standards in the business process management and transactions (such as BPEL4WS, WS-Coordination and WS-Transaction) (45,8%).

Robustness/Flexibility measures the service capabilities to work correctly even when invalid, incomplete or conflicting inputs occur. It is affected by service stability in terms of its interface and/or implementation. It is measured focusing on (i) explanation related error or exception raised by the service (78%), (ii) explanation related to frequently errors or exceptions (69,5%), and (iii) automatic service recovery (98%).

Reliability represents the ability of a service to perform its required functions under stated conditions for a specified period of time. It is measured focusing on (i) the number of fault during the service execution (45,8%), and (ii) the correctness of the service execution and information distribution (77,8%).

4. CONCLUSION

Quality is emerging as a promising approach to promote the development of service in e-government domain. It covers a fundamental role and it is useful to reason on the maturity of e-government and service in Public Administrations. The promotion of an citizens-based quality approach introduces a lot of advantages related to effectiveness, efficiency, transparency and accountability of government. It upgrades citizens' government ICT awareness, it reduces the cost of services delivery and improves the access to government.

In our opinion the delivery of public services should be tailored to the preferences, needs and expectations of users. Our methodology could be integrated in a quality driven e-government service development approach where service adaptation plays the fundamental role.

In future we are planning to validate our preliminary results. The sample size for this preliminary study is relatively small. We plan to extend the demographic area to Italian population. Each parameters will be measured and careful considers in line with citizens profiles expectations and service level. At the same time, we will propose the application of the model to make a comparison among services (with the same functionalities) provided by several Public Administrations.

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POTENTIAL OF M-GOVERNMENT FOR AGEING SOCIETY IN JAPAN

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ABSTRACT

One of the challenging aspects of e-Government implementation is to ensure inclusion of the elderly population to benefit from new communication opportunities and enhance the quality of life. Inclusion of elderly people in e-Government, however, has a number of obstacles to overcome as age is recognized to be a significant demographic variable that is related to the usage of online telecommunication tools. Mobile applications have a potential of bridging generational gap in access to electronic government services and foster their engagement in public issues. This paper aims to exploit the potential of m-Government for an aging society in Japan. It highlights current government initiatives for improving quality of life of elderly population and their social participation and presents some mobile innovative applications developed for senior people.

KEYWORDS

Ageing society, m-Government, Japan, e-inclusion, elderly, accessibility.

1. INTRODUCTION

Nowadays e-Government has become an integral part of information society, providing more convenient, friendly, transparent, and inexpensive interaction between government and citizens. Potential benefits of inclusion of the senior people in e-Government refer to improved skills, increased employability; better health awareness and online access to health services; increased quality of life; strengthened community cohesion and trust; better access to information and engagement in public issues (e- Participation). (Ahituv et al, 2008) e-Inclusion becomes a particularly important issue given the increasing pace of ageing in Japan.

Demographic aging is defined as a rise in median age of populations and a growing share of people above age 65, which are caused by declining fertility and increasing life expectancy. (Muenz, 2007) In Japan, the pace of ageing was slower than in US and Europe until the early 1980s, when only less than 10% of the population was aged 65 or older. After that, the percentage started to surge. Japan's aging process is marked by its high speed relative to international standards. According to the government statistics in 2005 Japan became the fastest-ageing society when the ratio of elderly came to 20%. (Fuyuno, 2007) The elderly population is projected to increase by 7.7 million between 2008 and 2020. It is attributable to a continuous decline in the total fertility ratio and to extension of longevity to the top level in the world. (Yashiro, 2008)

Inclusion of elderly people in e-Government is quite challenging as older people are less likely to be familiar with computers and the Internet, and as a result are being not comfortable using online communication tools for interaction with authorities. Mobile phones on the contrary are rapidly becoming common property around the world. Given this trend, making use of mobile technologies could be very useful for the governments to assure stable and efficient communication and inclusion of senior people into social and political life.

This paper aims to explore potential of m-Government for aging society in Japan. It takes technology-based view of challenges and prospect of establishment of m-Government for elderly people in Japan. Since the main drivers of m-Government activities include major changes in the technological infrastructure and the advances in mobile telecommunication services (Kushchu, Kuscu, 2003), this paper first focuses on these two issues in regard to elderly people in Japan. It highlights current use of mobile technological infrastructure by the senior people in terms of mobile device and mobile Internet penetration level. Second, it concentrates

on accessibility challenges of mobile devices and mobile content for elderly population. And finally, it evaluates the advances in Japanese government efforts in promotion of mobile services development for e-inclusion of elderly population.

2. M-GOVERNMENT FOR THE ELDERLY

2.1 Accessibility Challenges

e-Government encompasses the usage of all information and communications technologies to deliver governmental services to citizens and improve the quality of governmental activities, the governments have been primarily focused on Internet as mean of public service provision. M-Government, being an extension of e-Government, refers to strategic utilization of all kinds of mobile technology, services, applications and devices for improving benefits to the parties involved in e-Government. Most of m-Government services represent services offered to the users in different fields (such as Health, Education, Security, Democracy, Culture, Tourism, Police, Parking, Taxes, Transport) or/and offered to specific community (e.g. municipality, university campus, tourists etc.). The offers may include different types of applications serving as a support for activities of communities.

Consequently, the interactions and delivery models of m-Government are broad and include the following: Government-to-Citizen or Government-to-Customer (G2C), Government-to-Business (G2B) and Government-to-Government (G2G) as well as Business-to-Citizens (B2C), Business-to-Business (B2B) and Citizens-to-Citizens (C2C). (Rannu et al, 2005) The role of the government in the development of mobile services may have different intensity - from initiation, coordination and financing of the projects to indirect assistance, such as creating a good environment for development of the services by the other parties.

Widespread acceptance of mobile phones is seen as one of the key factors for reaching citizens who are, for some reasons, reluctant to use PCs and PC based access to the Internet for communication with public and government institutions. Elderly people are a segment with the lowest usage of PCs. Elderly people are those most often to state that they have difficulties with using a computer and are therefore not familiar with the internet. (Ahituv et al, 2008) The use of the mobile phone among elderly people on the contrary has become more common. In this case m-Government applications may become a key method for reaching senior citizens and promoting exchange of communications.

This initiative, however, confronts the challenges of usability and accessibility of the mobile content and mobile services by the older population. (Hellman, 2007) Holzinger, Searle, Nischelwitzer (2007) associate these challenges with 4 main problems of the elderly: cognition, motivation, physical impairments and perception.

Most of the features in today's mobile phones demand good eye sight and fine motor skills to operate them easily which often lacks in individuals on the prime of their age. Majority of the people above 60 suffer from disabilities like difficulty in viewing objects and print in close proximity, hearing tinny, high-pitched speaker sounds, muscular degeneration, glaucoma, cataracts, or diabetic retinopathy.

Besides perception difficulties elderly may have some physical impairment. There are a number of common illnesses classified as age-related, for example a rheumatoid arthritis, which is shown to cause isolation and depression in the elderly and sometimes hinders the use of technological innovations which could help reduce the isolation caused by lessened motor activity. Other effects of aging include slower response times, coordination reduction and loss of flexibility. There are five distinct human factors which show measurable disparities between older and younger people: learning time or time to perform task, speed of performance, error rate, retention over time and subjective satisfaction. Combination of physical and perceptual impairments may contribute to a loss of confidence, which leads to difficulty in the absorption of information and results in unwillingness to use ICTs for social and political purposes. (Holzinger, A., Searle, G., Nischelwitzer, 2007)

Moreover older users also have problems understanding the technical meaning of the handset menus and help descriptions due to lack of knowledge of recent technologies and cognitive disabilities. The usability of the application essentially supports the acquisition of new knowledge procedures in order to operate and interact with the application properly. (Holzinger, A., Searle, G., Nischelwitzer, 2007) Since cognitive

performance slows down with age, elderly people have difficulties interpreting what is seen or heard and difficulties making mental connections between different pieces of information, or have trouble with abstract reasoning. The type and degree of cognitive impairment can vary widely. Most common cognitive impairments are dyslexia, dyscalculia, learning and language disabilities, and dementia. (Hellman, 2007)

Another problem of elderly with using ICTs for communication with public authorities arises from motivation. Though mobile and electronic services are considered today to be more convenient and faster than traditional services, for elderly people they seem to be difficult to use, complicated, not as safe or reliable as traditional services. (Ahituv et al, 2008) One portion of motivational barriers relates to attitudes and beliefs created with respect to the general use of ICTs, including mobile devices for communication with public institutions. Although people are familiar with using mobile services, the current usage is mostly focused on voice telephony, “leisurely communication” and entertainment purposes. Therefore, users and especially older users may be unaware of the value that can bring the usage of mobile technology in other areas.

Elder people can also have attitudinal barriers stating that they do not need the ICTs. Researchers relate the lack of interest to the usage of ICTs with low expectations about measurable benefits and low confidence in own learning skills (Ahituv et al, 2008), (Holzinger, Searle, Nischelwitzer, 2007). This is supported by other studies which found that older adults are motivated to use mobile applications when they are sufficiently informed as to the resulting benefits. Moreover, Holzinger et al. refer to the research that showed that older adults tend to lose concentration easily and become bored with the subject, as result of anxiety that is based on the mistaken distrust in one’s own capabilities. Thus, the unwillingness to use mobile technologies is motivated by both unawareness of benefits and value that mobile services could bring them and reluctance to learn a skill, which is seemed to be difficult to acquire and requires special knowledge.

These challenges of using modern technology can be nevertheless resolved through the correct interface design and motivation.

2.2 Potential of m-Government in Japan

2.2.1 Mobile Device Penetration

Older people in Japan are increasingly becoming owners of mobile phones. The rate of mobile phone usage at the end of 2007 was over 60% for the late 60s age group. (Ministry of Internal Affairs and Communications (MIC), Japan, 2008) The generational gap for PC usage is wider than for mobile phone usage as the use of PCs demands a fair amount of knowledge or “digital skills” lacked by older people. The rate of PC usage was over 80% for people aged 13 to 49, whereas it dropped to 66.8% for the 50s, 48.2% for the early 60s and 28.5% for the late 60s. As for the mobile Internet usage, there is a significant growth during the last three years among those aged 50 and older (MIC, 2008).

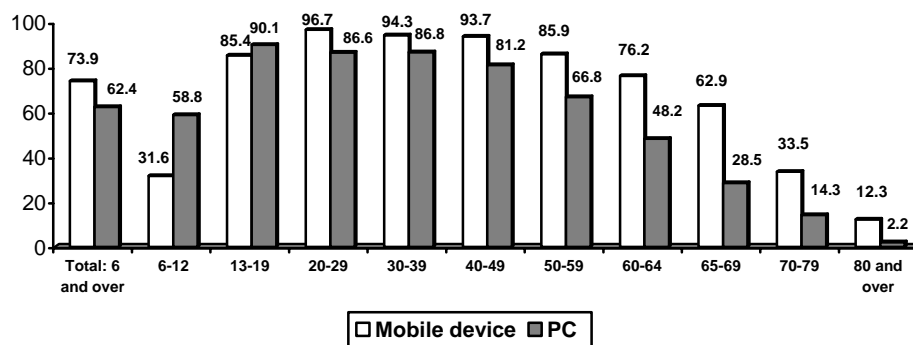


Figure 1. Usage Rates of Mobile Phone and PC by Generations (Individuals) in Japan as the end of 2007. Source: Ministry of Internal Affairs and Communications, Japan

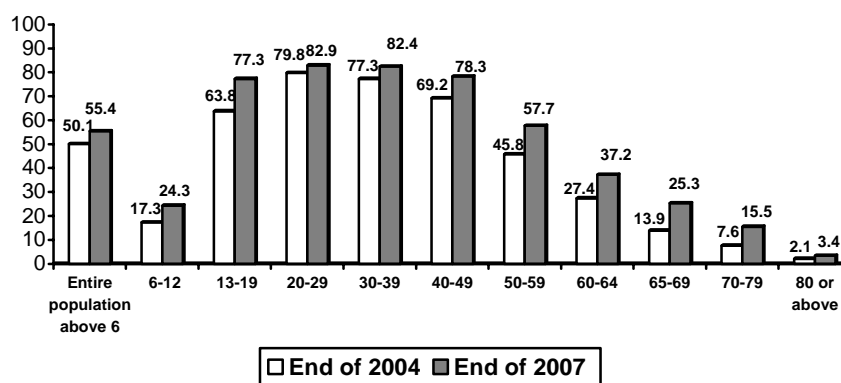


Figure 2. Usage Rates of Mobile Phone Internet in Japan as the end of 2007. Source Ministry of Internal Affairs and Communications, Japan

2.2.2 Accessibility of Mobile Devices and Applications

In order to compensate for the challenges of physical and cognitive impairments, manufactures have introduced Universal Design which aims to meet the specific technology-related needs of all people to the greatest extent possible, without the need for adaptation or specialized design. (The Center for Universal Design, 1997) The extensive uptake of Universal Design by manufacturing industries in Japan is believed have been facilitated both by the activities of the International Association of Universal Design and “some deeper-seated factors within Japanese corporate culture or values within its society as a whole”. Among these factors Macdonald mentions (Macdonald, 2007): 1) the tradition of relatively stable lifetime employment in Japanese corporate culture, 2) the creation and sustained support of a cohort of young and dynamic design managers informed in UD principles and philosophy, 3) the absolute devotion to understanding and satisfying the customer, and 4) the engagement of users through specialized user research tools.

Introduction of universally designed mobile phones was pioneered with Raku-Raku phone by NTT DoCoMo in 2001. NTT DoCoMo's strategy with the Raku-Raku phone concept has been built on three fundamental—easy to read, easy to hear, easy to operate. (NTT DoCoMo, 2008) The simple and easy to use interface has been achieved by providing big buttons, enlarged font size, easily viewable display, features to support visual functions, audio features such text reading and voice-activated call feature based on recognition technology. (Irie, Matsunaga & Nagano, 2005) The mobile phone continued to evolve through a series of generations introducing more features to increase usability for elderly. Some mobile phones have a camera which is to be used as a ‘magnifying’ device for reading text, “Slow Voice” features to slow down the caller’s speech, “Clear Voice” noise reducing feature to filter out the ambient noise to make the call clearer and adjust the ringtone volume to suit. Text messages, emails and web pages are also possible to be read out using an automated voice service as are incoming calls. (Altoft, 2007)

Another group of mobile phones targeted at senior people allows one to do only four basic things: turn it on, turn it off, dial a number and accept a call. These phones have regular numeric keypad and one button dialing capabilities which are suitable for the older people. Some models have “technically appropriate sound quality and volume adjustment for older hearing capabilities”. (Macdonald, 2007)

NTT Group appears to be very active in developing ICT-based support structures that will help to relieve anxiety and loneliness among elderly people. During fiscal 2007, NTT laboratory groups pressed ahead with R&D in these areas, and NTT Group companies carried out field tests of various solutions. (NTT Group, 2007) One of the most popular services is location-based service “ima-doco” (“Where are you now?”) which allows finding or monitoring old people unable to take care of themselves with the use of satellite-based Global Positioning System and a mobile phone network. The mobile phone introduced by NTT DoCoMo features a 100 dB (approx.) emergency buzzer and light operated by pulling an emergency cord that, when activated, automatically makes a phone call to a registered phone number, with two alternate numbers called in succession if contact cannot be established. Guardians may also sign up for the “ima-doco” search location service. Mobile communication service oriented toward elderly health needs is also reflected in au-KDDI’s Helpnet which is a one-button push emergency service to signal the location of the caller. (Abe, 2006)

One solution is monitoring services that alert family or local authorities in case of changes in the well-being of elderly who live on their own or with other elderly people. Such monitoring services use ICT to transmit data from a sensing system without putting any burden or stress on the individual being monitored. This service is also available in one of the latest models of Raku-Raku phones. It has health management features, such as a built-in pedometer and heart-rate meter. It is designed to link with an external scale and blood pressure meter via an infra-red signal port, enabling the compilation and analysis of the user's medical data in graph form. The data is analyzed, and then health advice is given to the user. (NTT DoCoMo, 2008)

Another solution developed by NTT Group, provides preventive health care support to help maintain the health of elderly people who do not require care directly. ICT is used to connect elderly in their homes with a professional caregiver or rehabilitation center. This system enables participating members to communicate among themselves and to receive instruction on exercises that help to maintain sense of balance and avoid injurious slips and falls. To promote the deployment and use of these systems by local authorities, university hospitals throughout Japan, company conducted several field tests during 2007 (NTT Group, 2007).

Another area is the provision of emotional support by helping to relieve the loneliness of those who live on their own or link them with other family members. One such solution is NTT's Life Support - a communication service in which volunteers and professional caregivers are communicating from their homes via broadband videophone to connect with and listen to the cares and concerns of elderly people living on their own. (NTT Group, 2007) (Abe, 2006)

2.3 m-Government Initiatives for the Elderly People in Japan

In Japan challenges of aging society are being addressed by the government in general policy areas as well as in specific legislation and regulations. The latter involves the General Principles of Universal Design Policy introduced by Japan's Ministry of Land, Infrastructure and Transport's (MLIT) in 2005 and Japanese Industrial Standards (JIS) such as its JIS 8341-1 "Guidelines for older persons and persons with disabilities – information and communications equipment" which were used in the process of developing standards across the sector and bridging the "digital divide". (Macdonald, 2007)

Among general policies addressing aging society challenges are e-Japan strategy pursued since 2001, and the New IT Reform Strategy adopted by the government in 2006. The aim of e-Japan is to create a "knowledge-emergent society," where everyone could actively utilize information technology (IT) and fully enjoy its benefits. The e-Japan Strategy consists of four priority areas: 1) building an ultra high-speed Internet network and providing constant Internet access at the earliest date possible, 2) establishing rules on electronic commerce, 3) realizing an electronic government and 4) nurturing high-quality human resources for the new era. Among the features of ideal IT society this documents mentioned social participation where physically handicapped and the elderly will be able to take part in society more easily, and volunteer or other social activities will be more readily available.

In 2006 the government issued The New IT Reform Strategy as a new general policy program of the IT society in Japan. (Koga, 2006) This program outlined the measures for realizing a society in which : 1) the aged are able to live their remaining days with purpose; 2) all people have access to high-quality and efficient medical insurance, medical care and social services of life; 3) all persons including senior citizens, the disabled, can obtain education whenever they want to learn and can work whenever they want, thereby promoting social participation, and to raise the quality of services that will support such persons to transform society into one where all persons can enjoy healthy, prosperous, and active lifestyles. One of the core measures of the policy package was creation of support systems for ICT usage for elderly and disabled through promotion of universal design adoption. To achieve objectives defined in the program, the government set up special study groups (such as Strategic Council on Bridging the Digital Divide, Study Group on Broadcasting for People with Visual and Hearing Disabilities in the Age of Digital Broadcasting etc.) comprised of the experts from both government and private sector. The government efforts however were mainly focused on infrastructure, be it promotion of the services for the elderly and disabled people or digital divide problems considered only from geographical point of view.

Among general government policies with direct connection to m-Government is u-Japan strategy launched in 2006, with the aim to establish ubiquitous network society in which "various services are provided and people's lives made more prosperous through the ability of everyone to link to networks at any time, from anywhere, and from any appliances". (Murakami, 2003) The "u" in u-Japan represents the "u" for

“ubiquitous,” “universal,” “user oriented,” and “unique”, shifting the focus on the user in Japanese IT policies.

Ubiquitous networking relies on broadband infrastructure which includes not only wired systems, but also wireless and mobile systems. In network society ubiquitous services market can be roughly divided into four categories (1) ubiquitous individual services for persons; (2) ubiquitous business services for companies; (3) ubiquitous public services provided by both private and public sectors; (4) ubiquitous administrative services provided by the public sectors. The last two groups of services are addressing u-Government initiatives, extending the way of interaction between public and administration from wired broadband to mobile and wireless broadband platforms. Thus, it might be assumed that ubiquitous information society concept implies at more sophisticated level the incorporation of m-Government services, though doesn't use such term in their respect.

There are three policy directions taken under the u-Japan: (1) development of the ubiquitous network infrastructure, (2) ICT utilization to resolve the emerging economic and social problems Japan will face as it moves towards the 2010s and (3) establishment of a safe and secure usage environment. (ITU, 2005)

Since initiation of the e-Japan Strategy in 2001, the government was involved in different infrastructure activities resulting in steady development of broadband networks and establishing interconnectivity and interoperability between them. These has given a rise of a wide range of mobile and ubiquitous services available in Japan such as digital wallet services, mobile digital music, portable TV etc.

While the ubiquitous network is on its way toward development, the government is making efforts to address the second aspect of u-Japan policy. It relates to the user side, namely to the actual resolution of the emerging economic and social problems by the ICT utilization. At the first stages of u-Japan policy implementation, government support was given to intelligent traffic system and vehicle information and communication system projects. However, little attention, if any, has been given to the development of ubiquitous public services and ubiquitous administrative services.

In order to stimulate use of the ubiquitous network for solving social problems, the Ministry of Internal Affairs and Communications in 2006 began awarding the "u-Japan Best Practice Grand Prize". (Murakami, 2008) The prizes are awarded to practical models of information and communication technology services and systems that provide the answers to a variety of problems in everyday personal and business life. Variety of solutions are being developed and proposed by different players including not only ICT companies, but also universities, communities and medical institutions. “The more promising are the solutions, the higher the priority that is given to their dissemination throughout the country”. (Murakami, 2008) Very few of them however have been developed specially for the elderly, though many, like those developed in the healthcare area possess indubitable value for the senior people.

The third direction of u-Japan policy relates to “the most vulnerable issues of the usage environment”, namely safety and security. (Murakami, 2008) To solve these problems, strategy assumes such measures as strengthen security by amendment of current legal system that regulates communications and broadcasting and by user education and training. These measures might be very contributing in building trust and elimination of the negative perception of elderly population towards u-Government services as being difficult to use, complicated, not secure or not private and reliable as traditional services.

Thus, Japan has the necessary framework stipulating development of ubiquitous government services for the elderly people and their engagement into social participation. From one side, there is a well developed general strategy proclaiming the establishment of ubiquitous network society where all persons can enjoy healthy, prosperous, and active lifestyles. But on the other hand, while the general policy framework exists, it doesn't prioritize the e-inclusion of older people and lacks more concrete measures promoting development of public and administration services for the elderly people. Moreover, though e-government and e-administration are listed among the priorities of IT policies and ubiquitous administration services are included in the concept, the mobile dimension still remains out of government attention and unexploited.

Government policy has been successful in promoting the development of technologies and applications compensating physical and cognitive impairments. Created infrastructure possesses potential for the older populations to be an active part of society. However, to exploit it, there is a need to shift the focus from the infrastructure to the services. This requires a user research to be done. To increase the convenience in communication with government authorities and offer more services for the participation in community life and decision making it is necessary first to know the potential users, their level of e-readiness, cognitive and physical impairments, motivations, aspirations, desires etc. and then to develop the services that would match them. Besides development of the m-services, various assisting trainings on the use of mobile applications

for accessing government services should be foreseen to resolve the motivation problem arising from low trust and confidence in own learning skills.

3. CONCLUSION

Implementation of m-Government relies on availability of mobile infrastructure and its uptake by the users. Eight years have passed since Japan has launched its ubiquitous networking initiative. In this period of time Japan has achieved steady results in the development of broadband networks. High uptake of mobile services among the elderly population was possible due to accessibility of mobile phones and content offered by mobile manufacturing industry, which came to realize the significant market opportunities brought by the needs and lifestyle aspirations of its ageing society.

Mobile services and applications for elderly people available to date in Japan are represented by Business-to-citizens interaction model. At this moment, the Japanese Government was not involved directly in service development or promotion processes of m-services to elder people. The government efforts have been focused on creating a good environment for the development of these services by the third parties. Such an attitude has been beneficial to the development of mobile phones and applications under universal design approach addressing particular needs and compensating physical and cognitive impairments of elderly population.

However, no attention has been given to the development of mobile content for government administrative services for senior people. In spite of some positive outcomes of government initiatives, to date the Japanese government did not succeed in disseminating ubiquitous government services among the elderly. This situation requires more research to be done to acquire knowledge on the current needs of older people in Japan and the potential of ICT to satisfy them. More efforts are needed to be focused on exploring the implications of mobile services for social inclusion and engagement of elderly in overall government affairs, with subsequent training and assistance in its usage for overcoming possible motivation and attitudinal barriers. These initiatives should receive a stronger legislation support and should be prioritized in the government policy programs and action plans on e-inclusion of elderly population.

ACKNOWLEDGEMENT

The author expresses her gratitude to the anonymous referee for their comments and suggestions that led to significant improvement of the original version of this paper. All presented opinions and remaining errors belong solely to the author.

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EGOVERNMENT INTEROPERABILITY PROBLEMS IN LITHUANIA

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ABSTRACT

The paper analyses the importance of interoperability, interoperability constraints and interoperability role in development of eGovernment. The interoperability challenges were faced in different EU countries since 2000. System complexity, multiplicity and diversity in the public sector is posing extreme challenges to common interoperability standards the eGovernment Interoperability Frameworks (eGIFs) pose as a cornerstone for the provision of one-stop, fully electronic services to businesses and citizens. The paper analyzes eGovernment development preconditions in Lithuania, overview and good practice experience in developing eGovernment interoperability framework at EU level (European Interoperability Framework) and national levels – UK, Germany and Greece. Comparing these frameworks by different criteria the guidelines for developing eGovernment interoperability framework in Lithuania are designed. The project for Lithuania eGovernment Interoperability framework development is supported by Ministry of Interior of the Republic of Lithuania and State Science and Education Foundation.

KEYWORDS

Interoperability, eGovernment, Framework, Lithuania.

1. INTRODUCTION

Realisation of one-stop government and joined-up government is easier said than implemented. Providing citizens with services according to their needs calls for collaboration within and across public authorities and hence, essentially requires changing the *modus operandi* of the public sector. Indeed, citizens have needs that in many cases can be fulfilled only by aggregating information and / or services traditionally provided by different public authorities. Furthermore, putting citizens at the centre of service provision suggests providing them with multiple communication channels for the same service.

In this huge modernisation effort, it was soon realised that interoperability would play a significant role. At a first glance, it seems that resolving all interoperability obstacles would be a non-trivial task. For example, in some cases public authorities do not exchange data due to legal constraints, either because there are no laws to enforce public authorities to collaborate or because there are laws on data protection and privacy that may prevent authorities from exchanging data. Even when the legal framework is in place, setting up the appropriate inter- and intra-organisational workflows is not trivial. Even when this is resolved, all collaborating authorities must share the same understanding on the data that are exchanged. Finally, the automatic exchange of data should be technically feasible, even in those cases where the participating public authorities have different information systems in place. (Tambouris, 2007)

Interoperability is not a new concept in the domain of computer systems. Interoperability of computer system is defined by IEEE as “the ability of two or more systems or components to exchange information and to use the information that has been exchanged”. Electronic dictionaries define interoperability as “the ability of software and hardware on multiple machines from multiple vendors to communicate”. For the purposes of this study, we define interoperability as *the ability of distinct systems to communicate and share semantically compatible information, perform compatible transactions, and interact in ways that support compatible business processes to enable their users to perform desired tasks* (Rothenberg *et al*, 2006). Although our definition of interoperability was derived from a technical perspective, it applies to all aspects of

eGovernment, if “system” is interpreted broadly. Note that this broad definition implies that an interoperability framework is far more than just a list of recommended standards.

From the early days of eGovernment, interoperability was perceived as a critical challenge and enabler. Interoperability has a central role in eGovernment and as a result significant work has been already conducted. Since 1991 interoperability has remained an important EU goal – especially in the eGovernment context. To take one particularly pertinent example, in June 2002 the eEurope 2005 Action Plan made the development of a European Interoperability Framework (EIF) a priority component of pan-European eGovernment strategy (Müller, 2006).

2. CONSTRAINTS FOR EGOVERNMENT INTEROPERABILITY

There are different types of constraints for eGovernment interoperability. Klischewski and Scholl (2007) outline nine of such:

- Constitutional / legal constraints;
- Jurisdictional constraints;
- Collaborative constraints;
- Organizational constraints;
- Informational constraints;
- Managerial constraints;
- Cost constraints;
- Technological constraints;
- Performance constraints.

Tambouris and others (2007) outlines key factors in a broader political, legal, managerial and financial sense.

Along the first dimension, authors introduce four types of key factors for interoperability governance:

- Political: factors that are related to broader policy and institutional issues and should be addressed by political personnel;
- Legal: factors that need legal action;
- Managerial: factors that pertain to organisational, managerial and technology related (e.g. decisions on technologies to be used) issues and should be dealt with by public administration professionals and managers;
- Economic: factors related to financing and budgeting.

Along the second dimension, we identify three levels where action should be taken:

- EU Level: aspects that should be addressed at the EU level;
- National Level: aspects that should be addressed at the national level;
- Agency Level: aspects that should be addressed at the agency level.

The details of key factors are provided below (Tambouris, etc. 2007):

Political

- Development of national eGovernment interoperability strategy and programmes;
- Promotion of organisational federalism as a model for organising the diverged administrative space into a cooperative environment;
- Significance of international interoperability aspects.

Legal

- Legal alignment to address the new requirements posed by intensive public administration agencies cooperation;
- Protection of intellectual properties in multi-partner projects and developments;
- Diffusion of digital signature and electronic identity;
- Citizen privacy and data protection.

Managerial

- Clear interoperability leadership / ownership / sponsorship / management;
- Flexibility / transferability / reconfigurability of the interoperability solutions;

- Adoption of any relevant available standard and proposal of new standards in areas where standardisation is missing;
- Broad commitment, participation and communication;
- Willingness for cultural change at all partners;
- Staff training related to interoperability projects.

Economic

- Adoption / switching costs inherent to interoperability solutions;
- Public procurement policies and financing for interoperability projects;
- Partnering with the private sector in interoperability projects.

These key factors groups also might serve as different dimensions of interoperability. Unless in narrow perspective interoperability might seem as only technical issue (pointed out by Klischewski and Scholl), it also brings a set of other dimensions – political interoperability (which also might cover legal and partly economic issues), organizations interoperability (including managerial and economic issues) and semantic interoperability.

3. EGOVERNMENT DEVELOPMENT IN LITHUANIA

One of the most important tasks of a modern state is to create a system of public administering to be efficient and inexpensive and designated for promotion of the citizens' needs and welfare. The Ministry of the Interior of the Republic of Lithuania when implementing the state policy in the area of public administering is to coordinate the state general policy to be implemented in the area of public services provided to citizens, including:

- within the scope of appropriate competence the formation of the strategy of expansion of the information society of the Republic of Lithuania, the application of information technologies to the state management and participation when implementing it;
- coordination of the information technologies security in state institutions and enterprises;
- management of electronic government projects and provision of public services with the use of digital technologies supervising;
- coordination of participation in programme of electronic data exchange (IDABC) between the administrations of Lithuania and the European Community;
- also other functions to be performed in the area of public administering and information society.

For purpose of modernization of the public administering systems, the Ministry of the Interior has elaborated the project on Public Administering expansion strategy up to the year 2010 approved by the resolution adopted by the Government of the Lithuania. One of the most important areas of this strategy implementation is eGovernment. eGovernment shall be understood as the integrity of information and communications technologies implemented in the area of public administering, improvement of organizational changes and new skills applicable to public services, democratic processes and foreign policy. eGovernment definition contains the main eGovernment targets to be as follows:

- to increase the transparency in the process of adoption of executive power's decisions;
- to ensure the access to eServices;
- to provide the society, business subjects and institutions with public services and information in a more qualitative and efficient way.

It is necessary to note that eGovernment covers not only technological aspect, but also political, social and other aspects. „Based on politic aspect eGovernment can be perceived as “the appropriate democratic mechanism, taking into consideration its relation with public information processes, spread of civil information and development of public environment“; i.e. a democratic potential of eGovernment is being disclosed through communicatory aspects. The eGovernment social aspect is related to the knowledge society trends and „based on this the eGovernment impact on the way of living is being disclosed” – i.e. eGovernment is to ensure and further develop changes in way of life related to such factors as the Internet impact, problems connected to digital coverage, the governmental attitude to global factors and other”.

When gradually modernizing public services, most these services are being provided at local, regional or national level, some international services can be considered as extremely important for citizens, business

and administering institutions and may become the examples eGovernment of Europe. They also can help undertake appropriate obligations upon the highest level and create the demand for the main means, such as electronic identification and interoperability. Management of electronic identification, ensuring the interoperability related to access to public services, approval of electronic documents' authenticity and electronic archiving shall be implementation means of prime importance. However, when implementing the above means, it shall be extremely important to honour various national methods and solutions, avoiding obstacles for the use of public services overseas.

While precipitating the process of eGovernment creation the modernization and innovations shall become of prime importance, because citizens require governmental authorities to provide better public eServices which have to be more protected and democratic and business representatives require less bureaucracy and more efficiency. Surveys being carried out in the field of needs for public services and their supervising have proved that provision of public services upon information and communications technologies means is beneficial for these governmental authorities. Benefits are related to improvement in the area of the public service provision operational efficiency, increase in citizens' loyalty and decrease in functions of the state institutions' personnel and public services provided can be described as high-quality, quickly-used and publicly accessible. However, according to the aforementioned surveys business has far more leading position in the area of provision of public eServices compared to state institutions. A lot of Lithuanian business subjects are providing public services on-line within their Internet web-sites at the highest level, many of them provide their customers with the following on-line services: commercial transactions, money transferring, payment for utility services, securities' transactions and others. On the model of business subjects the state is trying to modernize the activity of its institutions on a more improved way; when developing eGovernment services the state shall interact with citizens and business subjects on the basis of providing its information and services in an easier, more convenient and faster way. A great impulse for development of public eServices could be based on supporting funds provided by the European Union that would be used for implementation of projects on eGovernment services, therefore, it is expected that the scope of eGovernment services in Lithuania shall be increasing in general. Nowadays, the following eGovernment services provided in Lithuania can be considered as well-developed:

- Declaration of residents' and legal persons' income;
- Payment of state social insurance premiums;
- Submission of customs declarations;
- Submission of statistic data;
- Job seeking and employment services;
- Services provided by public libraries.

On the basis of the model created for electronic public services in October 2004, a pilot project "Development of portal functional and technical infrastructure and services" was started. After this project, public service "announcement of movement" and all related services will be transferred onto the Internet. Possibilities to implement other public services on the basis of "one-stop-shop" will be embodied. Software will ensure input of user data to the information systems of the Migration Department and the Resident's Register Centre and will ensure review of data in the Real Estate Register.

The goals of the portal are:

- Integrated Internet access to information and public services delivered by state institutions;
- The content of portal users should be reachable by computers or mobile phones;
- A list of links to Public organizations and State institutions websites should be available on this portal; and
- All existent links in the portal should be grouped by residents and business enterprises.

Limitations of the present portal:

- There is no identification system of visitors implemented in this portal, without this system it is impossible to provide fully interactive electronic public services.
- The "one-stop-shop" principle is not realized. Users should only have to identify and authenticate themselves once to obtain any electronic public service independent of institution providing it.
- Electronic documents produced by civil servants now are doubled in paper and electronic form. It is impossible to ensure security and archiving of them for a defined period of time.

- It is difficult to manage newly appearing electronic public services and changes with already existing procedures.
- The bureaucratic procedures are unclear (can be also excessive) for a user that needs to know what institution provides what services.
- Complicated maintenance of the portal.

However, interoperability of information systems of state institutions is mentioned in various strategies. An electronic signature infrastructure was created and implemented. A project called “Creation of Interoperability of Public Administration Institutions’ Information Systems” was begun in 2006. The purpose of the project is to create an interoperability framework of institutions and a portal with central identification. June 2008 new project was begun which aims to develop Lithuanian eGovernment Interoperability Framework in order to provide Lithuanian government with guidelines for dealing interoperability issues at national level. But at the moment an explicit strategy for interoperability does not exist.

4. EGOVERNMENT INTEROPERABILITY IN EUROPE

Because eGovernment interoperability frameworks are still a relatively new concept, there are not yet many examples to choose from, and most of those that exist appear to be well known.

Nowadays, building an eGovernment Interoperability Framework must oppose the tendency to “reinvent the wheel” and requires examination and extended review of related research and standardization efforts in the EU, the UK, Germany, Greece and other EU countries (see Figure 1).

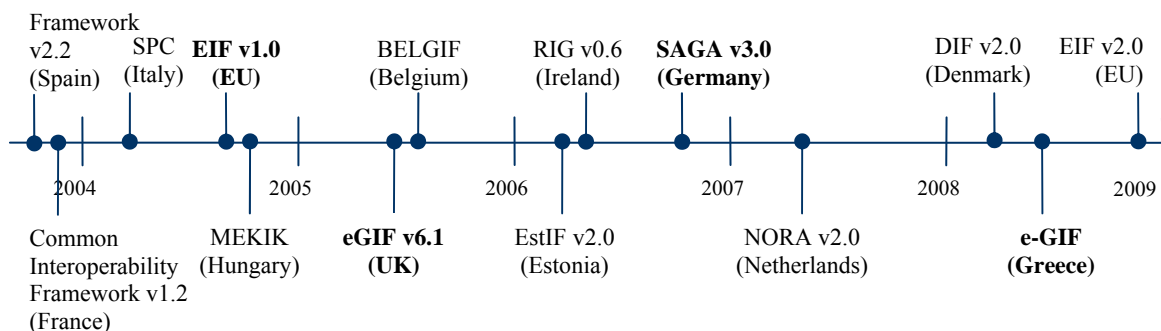


Figure 1. eGIFs in European Union

This paper present comparison of best practice in implementation of eGovernment interoperability frameworks according certain criteria in following countries:

- At European level, the European Interoperability Framework – EIF (Version 1.0).
- eGovernment Interoperability Framework of United Kingdom.
- Germanys’ Standards and Architectures for eGovernment Applications (SAGA) Version 3.0.
- Greece and its’ new Greek eGovernment Service Provision and Interoperability Framework.

Despite being small, this sample provided a good mix of national and EU efforts. The specific rationales for our choices were as follows. The EU EIF was a given, since it provides an overarching set of interoperability criteria (the IDABC Architecture Guidelines provide a related architectural perspective). Most national interoperability frameworks refer to the EIF as well and strive for at least partial compliance with it. The UK’s eGIF is one of the most mature (in the sense of having been around longest and having been through the most revisions) and complete of the national interoperability frameworks and is heavily referenced in other interoperability frameworks, making it a natural choice. Germanys’ SAGA is second of most mature interoperability frameworks. Greece brings to the sample ambitious and most recent effort of so called second generation interoperability framework.

The results of different eGIFs are presented bellow comparing them by interoperability dimensions addressed, layers identified, scope and interest groups. Interoperability is frequently viewed as having number of distinct *dimensions*. One of the earliest views of interoperability is the *layered* or “stack” view of

interaction among computer systems over a network. The earliest popular version of this view was the traditional Open Systems Interconnect model, here are listed layers identified by eGIFs analysed. Scope and interested groups views are concerned with the functional range of an interoperability frameworks. Within the broad domain of eGovernment, interoperability may be tasked with a range of different scopes.

Table 1. Comparison of different interoperability frameworks

Criteria	EIF	UK eGIF	SAGA	Greek eGIF
Dimensions	Organizational interoperability Semantic interoperability Technical interoperability Political context Legal interoperability	Only technical interoperability covered	Organizational interoperability Semantic interoperability Technical interoperability	Organizational interoperability Semantic interoperability Technical interoperability
Layers	Basic Public Functions Secure Data Exchange Aggregate Services Administration, Business, Citizens	Interconnectivity Data integration Content management metadata eServices access	Enterprise viewpoint Computational viewpoint Technical viewpoint Engineering viewpoint Information viewpoint	Systems Standards and specifications Coordination
Scope	Direct interaction between citizens or enterprises of one Member State with administrations of other Member States and/or institutions. The exchange of data between administrations of different Member States in order to resolve cases that citizens or enterprises may raise with the administration of their own country. The exchange of data between various EU institutions or agencies, or between an EU institution or agency and one or more administrations of Member States.	The eGIF covers the exchange of information between government systems and the interactions between: UK Government and citizens UK Government and intermediaries UK Government and businesses (worldwide) UK Government organisations UK Government and other governments (UK/EC, UK/US, etc.).	There are three target groups for the Federal administration's services: Citizens (Government to Citizens – G2C) Companies (Government to Business – G2B) Administration (Government to Government – G2G) SAGA's scope of validity covers the federal administration and software systems with interfaces between federal authorities and federal-state and/or municipal authorities in order to support the public services.	<i>Organisational aspect:</i> 20 ministries, 13 prefectures, 52 districts, 1000 municipalities and 1000 governmental “points of service” delivering over 3000 public services. <i>Systems aspect:</i> 200 governmental internet portals, 1000 municipal internet portals, 2500 public administration back office systems. <i>Non-governmental stakeholders aspect:</i> 750 000 companies, 11 000 000 citizens, 18 000 000 tourists per year and over 20 000 000 service requests per year.
Interest groups	Administration policy makers responsible for eGovernment service development and operation, Administration officials responsible for ICT systems implementation (and by extension any contractors working on their behalf)	UK government which includes central government departments and their agencies, local government, and the wider public sector, e.g. non-departmental public bodies (NDPBs) and the National Health Service (NHS).	SAGA is primarily designed for decision-makers in the fields of organization, information technology and eGovernment teams in German administrations.	All governmental institutions in Greece.

5. CONCLUSIONS

Basing on the analysis of best practice interoperability framework the following conclusions and recommendations might be provided towards formulating Lithuanian eGovernment Interoperability Framework:

- The impact of ICT on public administration processes is obvious. But the differences between the authorities and the different of ICT adaptation authorities bring an interoperability issues. These differences and unique ICT solutions in different institutions become the major obstacle to the development of efficient public services, electronic environment.
- Basing on the analysis of the European Union, the United Kingdom, Germany and Greece experience in interoperability framework development it is important to emphasize recently strengthened approach, the interoperability problem can be solved only in setting standards or specifications, but must be created to support the interoperability mechanisms and ICT-based solutions the controlling authorities.
- Based on the analysis of best practices future eGovernment interoperability framework should focuses on the second generation of interoperability framework trends. The framework should consist of traditional interoperability dimensions – technical, organizational and semantic interoperability, but also include a political dimension of interoperability, enabling the uniform policy as a necessary precondition for interoperability problems.
- Interoperability framework also contains systems that generate and / or processes sets of allowing the authorities to use existing good practice, and not to re-create original solutions. The eGIF must contain coordination component, which is associated with the existing systems certification and accreditation and the granting of the necessary knowledge.
- The eGIF should provide high level standards (the data, technical, authentication, web portal and multi-channel access standards) for systems used in public eService provision.
- The interoperability framework should be addresses to national level institutions. The further development of eGIF should take into consideration regional and local issues;
- Representatives of governmental organizations will be the main stakeholders in development eGIF.

ACKNOWLEDGEMENT

The current research was funded by Ministry of Interior of the Republic of Lithuania and Lithuanian State Science and Studies Foundation.

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E-ELECTION 3MS: MODELING, MANAGING AND MEASURING

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ABSTRACT

This article focuses on a challenging area of digital society, i.e. "electronic election". Lessons are learned from studying traditional approach to election within an organization responsible for forming trade councils of various industries via election among stakeholders. Accordingly, the strengths and weaknesses of the traditional election systems in a developing society are highlighted; consequently, the specifications of pure e-election, semi e-election and traditional elections are defined and three important driving forces of e-election in the real world are introduced. Considering standards developed for e-election prerequisites of e-election are introduced and two critical aspects, e-participation and e-infrastructure are discussed. Representing the demand and supply sides of e-election with e-participation and e-infrastructure, we introduce a roadmap for transition from the conventional election to modern electronic where the dominant driving force is e-society realization. Then, the significance of using a managerial IT-based dashboard throughout the transition period is highlighted and several basic e-participation measures are proposed.

KEYWORDS

Electronic Election, traditional election, driving forces, EML, Readiness, e-infrastructure, e-participation, e-election roadmap, measurement, developing country, digital society

1. INTRODUCTION

E-election is a major issue in both e-government and digital society domains because of its requirements and impacts on the government and society. Modern voting systems in developed and democratic societies have been diffused in different forms like electronic voting, kiosk voting, remote electronic voting, online voting or Internet voting (or i-voting) from 1990 to 2008[1, 2]. However, to the best of authors' knowledge, no precise and seamless guideline exists to support e-election deployment (not limited to e-voting) in developing countries. Democracy level and e-readiness vary with the developing country.

The governmental authorities of Iran have made efforts to modernize the conventional election system at the national level using ICT potentials. The implementation of e-government and move to digital society in Iran has received the attention of authorities and policy makers since 1990. The e-government national plan is a comprehensive strategic plan that describes the road to e-government vision. The main strategies are rightsizing the government, changes in managerial systems and structures, human resource development and drawing a citizen orientation plan [3]. Accordingly, governmental organizations are expected to make processes electronically available and to minimize physical attendance of citizens and business representatives in organizations to get information and service.

This article is an outcome of a research project conducted in Tehran Trade Organization (TTO) which is responsible for holding elections in various business areas which leads to the formation of council of experts in each area from real stakeholders, who are engaged in day to day affairs the area, for establishing rules and regulations of conducting business in the field.

TTO is a governmental organization with a wide range of subsidiaries and trade unions that govern trade related activities [4] and relies more on traditional processes to perform activities. A survey was conducted in Fall 2007 in TTO; the structured survey, intended for each trades' chief administrative officer, was conducted via mail and face to face interview. Survey responses were collected on the election processes, main challenges of traditional election system and managers expectations from e-election system; feedbacks received from both future candidates as well as the election executive team members.

The forms were analyzed and the traditional election workflow was recognized and documented. To standardize the election process, all common standards were surveyed and EML was selected as a comprehensive and precise framework to reshape the election.

E-election standard schema, developed by OASIS, helped us design the TTO e-election desired situation. All processes, standards, integration policies, security issues, e-election devices and system behavior clarified in EML form the TTO's to-be e-election system. Organization for the Advancement of Structured Information Standards (OASIS) developed standards and models for election and voter information services using XML. This high-level process model is derived from real world election experiences. It divides the whole process into 3 major areas, pre election, election, and post election; each area involves one or more election processes. One or more XML schema supports each process.

Accordingly, the traditional election process reengineered by the EML based framework was proposed. The main prerequisites of (e-election) development based on EML and e-government prerequisites merged to meet the e-election development requirements [5]. Then, the road to achieve the seamless e-election system was defined as the e-election development roadmap. After all e-election monitoring was elaborated based on survey results.

This article, first, highlights weaknesses and strengths of traditional election systems; then, it focuses on the specifications of traditional and electronic elections and prerequisites of e-election to provide insights required for modernizing the election systems using electronic channels and processes. Driving forces of e-election are also introduced, and transition stages from t-election to e-election are defined. The importance of e-election measurement and the need to design a dashboard is highlighted.

2. TRADITIONAL ELECTION: STRENGTHES, WEAKNESSES

The annual trade unions election has been done on the basis of people custom using non-automatic methods. The government and the TTO have important roles to direct the election process by helping firm trade unions, law enactment and finding the appropriate patterns from all corners of the world; however, election experiences shows that traditional and manual methods have sever drawbacks in real world. The aim of this paper is to find a framework which shifts the traditional election to agile and flexible e-election that can answer to the new dynamic and unpredictable users and policy makers needs [6].

Having studied the current election processes, interviews with TTO managers and trade unions, the authors worked out the strengths and weaknesses of the traditional methods used.

The strengths of the traditional election systems are:

- Policies common in trade unions are clear and well known to the traders.
- Current procedures seem easy and practical due to evolutionary changes resulted from past elections.
- Implementation costs of the existing methods appear to be affordable and acceptable in short term, if compared against modern methods.

- Current methods have grasped the trust of candidates and voters.
- The organizational structure have adapted to the needs of traditional election method.
- No need for modern technologies, skills, procedures, regulations, etc.

The weaknesses of the traditional election systems are:

- The election process is time consuming.
- The accuracy rate is questionable.
- participation rate is relatively low due to complex procedures
- Training costs spent on personnel is high due to high number of staff.
- Need to physical attendance is a barrier for those who are far away from the voting center.
- Time & place are barriers in the eyes of voters and candidates.

- Data analysis which is useful for managerial decisions is so complex that seems impractical.

All these strengths and weaknesses led the TTO managers to study development and use of the e-election system for conducting the annual trade unions election. As a result, the procedures were redefined using EML standard; and it appears to us that they may be useful for similar cases [7].

3. TRADITIONAL ELECTION VS. ELECTRONIC ELECTION

E-election systems such as Internet based ones, in order to be accepted by a large user community, should guarantee the basic properties of traditional election systems, i.e. voters' anonymity and eligibility and vote secrecy; and they should offer additional advantages that could favor their acceptance. The pure e-election system will be based on the following properties:

- Location independence, where users can vote from any location (public voting sites or at home) through access the Internet with a computer. This is realized by design and implementing a voting protocol based on Public Key Infrastructure (PKI) to ensure privacy and eligibility
- Support by a security system against attacks, user friendliness of the interface and ease of installation in order to facilitates uniqueness and integrity of the election system
- Device, equipping different voting places with suitable voting Kiosks and other required tools.

In this paper, e-election diffusion in the information society is recognized as the attendance of voters, election process and e-election devices. These main parameters help to distinguish the election situation from traditional to pure electronic election.

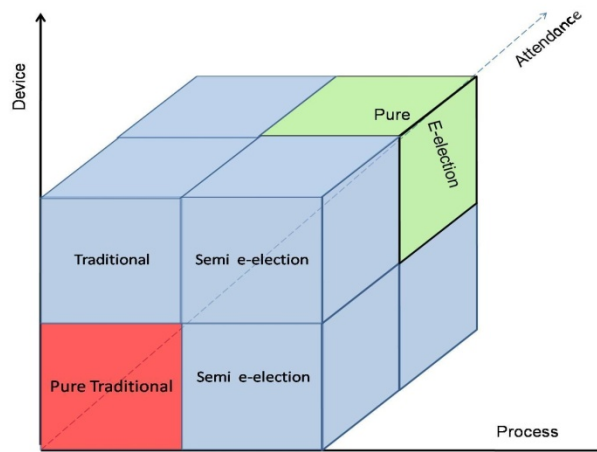


Figure 1. The categorization of election

The three dimensional cube in Figure 1 represents different stages between pure traditional election and pure electronic election. Each stage is defined further in Table 1.

4. E-ELECTION REQUIREMENTS

Promoting the infrastructure will become increasingly important throughout the country for national elections and within the organization for organizational elections. The provision of sustainable broadband services for the entire population will be emphasized. In order to realize e-election objectives, it will certainly be necessary to promote broadband services as well as e-election required hardware, software and databases. Moreover, the national promotion strategy should be combined with election organization initiatives in order to eliminate bottlenecks on e-election development as effectively as possible.

Table 1. E-election types description factors

Election	Process	Attendance	Device	Description
Pure Traditional	0	0	0	<ul style="list-style-type: none"> No e-election automation exists No digital signature possibilities No kiosks or terminals for e-election
Semi Electronic	1	0	0	<ul style="list-style-type: none"> Some/ All e-election processes are automated No digital signature possibilities No kiosks or terminals for e-election
Traditional	0	1	0	<ul style="list-style-type: none"> No e-election automation exists Digital signature makes it possible to vote from any where No kiosks or terminals for e-election
Traditional	0	0	1	<ul style="list-style-type: none"> No e-election automation exists No digital signature possibilities e-election terminals and kiosks are used
Semi Electronic	1	1	0	<ul style="list-style-type: none"> Some/ All e-election processes are automated Digital signature makes it possible to vote from any where No kiosks or terminals for e-election
Semi Electronic	1	0	1	<ul style="list-style-type: none"> Some/ All e-election processes are automated No digital signature possibilities e-election terminals and kiosks are used
Traditional	0	1	1	<ul style="list-style-type: none"> No e-election automation exists Digital signature makes it possible to vote from any where e-election terminals and kiosks are used
Pure Electronic	1	1	1	<ul style="list-style-type: none"> All e-election processes are automated Digital signature makes it possible to vote from any where e-election terminals and kiosks are used

However, this will require regular monitoring of ICT status at the national level. Additionally, the culture of e-election needs to be promoted in the public. The authorities must help people vote with trust; the candidates and voters must be convinced on the efficiency and security of e-election system. Security considerations of e-voting systems include authentication, privacy/confidentiality, integrity and non-repudiation which will be realized using digital certificate and digital signature. The other main requirements are the e-election standards for various stages from designing the e-election processes to implementing the total system.

These main prerequisites, as e-election infrastructure, help the election organization plan the move from traditional election toward e-election state. The main prerequisites for each phases of e-election are colored in Table 2.

As it is shown in Table 2, the e-election requirements are divided into four main groups. These groups are inspired from ICT developing models like CID's (Center for International Development at Harvard University), E-Readiness Assessment Guides and CSPP's (Computer Systems Policy Project) [8, 9, and 10]. The two readiness assessment guides are useful for ICT development within the society. The blue cells demonstrate the vital indicators that need to be realized to make the (sub) process possible. The yellow cells are optional indicators that will cause the process produce the best output and result, however, the lack of them doesn't make the process fail. The white cells are not important to that specific process.

Table 2 is designed to help the policy makers become familiar with e-election critical bottlenecks and prerequisites. Additionally, the authority responsible for planning and implementation of e-election will use it to develop the road map by focusing on these indicators [11].

Table 2. Prerequisites of e-election phases

Election Phases		Election Phases													
		Pre-election						Post-election							
		Election legislation	Candidates	Voters	Vote	Result	Audit	Analysis	Election legislation	Candidates	Voters	Vote	Result	Audit	Analysis
Development Prerequisites	Network speed & Quality														
	e-payment														
	e-election Apps														
	Integrated Database														
	Access to Internet														
	Election kiosks and terminals														
	Standards like EML														
	Election regulations														
	Authentication														
	Cyber crime														
	Civil Liability														
	Privacy														
	Media														
	Public Awareness														
	Training														
	Trust														
	Network and kiosks security														
	E-signature														
	Application Security														

Not important

Optional

Important

5. DRIVING FORCES OF E-ELECTION

Defining driving forces in e-election development is very critical because it will highlight the focus of investment and change management within the stages defined in the deployment roadmap. E-election development plan can be multipurpose. From the election organizer view, two main possible approaches to the e-election are:

1. E-election as a solution for improving intra organization performance causing election costs reduction, counting speedup, etc. (efficiency of election system)
2. E-election as a means of raising the number of participants and inclusion of those groups facing difficulties with time and distance barriers imposed by t-election requirements.
3. E-election as a means of narrowing digital divide and ultimately emergence of e-society. This can be considered as the combination of the above two approaches; because both voters and organizers are subjects of change management.

Each approach creates different results and consequently different barriers will be highlighted in development path (Table 2). The first driving force, (efficiency of election system, focuses on process automation, and the second one focuses on remote access, disabled facilities, removing the need to physical attendance at voting stations, etc. Major barriers to the e-election vary with the approach adopted. The first approach demands internal improvements and readiness of the election organizers; the second one, reminds us of the click-and-mortar business model adopted by brick-and-mortar organization to go online (for further reading please refer to [12]). The third one, in addition to the requirements of the two other approaches, confronts with issues of type public trust and awareness, IT literacy, and accessibility as main barriers of e-election realization [13].

As mentioned before, if the third approach is adopted, all voter registration databases will be consolidated, creating the basis for people to vote from anywhere across the country or even the world; in order to raise the voting rate and improving convenience for citizens, the voting systems linked to the Internet or kiosks will be developed. To conclude, professional and systematic analysis is required on e-election goals and objectives, initiatives, implementation strategies, and Monitoring of the progress rate and development status.

6. THE ROAD TO E-ELECTION

The success of e-election system is associated to a series of elements. Desired e-participation is affected to a large extent by public trust and capacity (quality and quantity) of e-infrastructure. Increase in e-transactions of type e-payment, e-learning, and e-sales shows the trust of people to electronic means and adequacy of e-infrastructure; and thus they can prepare grounds for the success of e-election.

For the success of e-election system both e-infrastructure and e-participation are essential; however, the question is that which one is ranked first? E-participation carries a higher weight in election time than in pre and post election times. We cannot expect people participation and improved productivity without a reliable e-infrastructure.

Figure 2 proposes a generic development path for e-election deployment at the country level. It indicates that in the earlier stages, the prime focus is on improving e-readiness and foundations required for e-election development. This leads to the use of e-election services, in later stages, by voters and candidates with focus on automating election processes. Finally, all indicators are developed and the rate of participants in e-election rises significantly. As far as the e-infrastructure indicators (shown in Table 2) are concerned, the proposed e-election system can effectively promote their use. It can enable the active e-participation of all stakeholders, i.e. citizens, enterprises, associations, etc. Also, it can support better policy making and coordination amongst ministerial departments, public agencies and layers of government. It means that the e-participation can be defined as a Key Performance Indicator (KPI). The ratio of e-participants in election to the voters using traditional services shows the success and attractiveness of the modern e-election system at each stage of progress towards pure-e-election. E-participation is a combinatorial result of both the government programs to encourage e-participation and the willingness of the participants to do so. In other words, it covers both the demand and supply sides [14].

Each stage is defined using certain requirements of e-election that are described below:

Stage 1: As-Is situation

No electronic forms exist, candidates information is registered on papers. No website exists to deliver information. In this stage, the three sub processes are managed manually and no software package for this purpose exists. However, e-election laws and regulations may exist or being developed. The policies required for transferring to e-election desired vision is developed and the projects are defined.

Stage 2: online access to election information

The e-election online presence comprises a web page and /or an official website; the candidate registration is fulfilled online. The pre election application is designed and developed. The pre election application is integrated to the e-payment service. Links to ministries/departments involved e.g. trade, labor and finance may/may not exist; archived information such as the election policies, laws and regulation, reports, newsletters, downloadable databases and previous elections information or documents may be available on line; most information remains static with the fewest options for users.

Stage 3: the presence of online election

In this stage, election application is developed and all election processes are conducted on line. Because of the e-signature lack, authorizing both voters and candidates must be performed in voting terminals, i.e. kiosks, election offices, etc. The voting terminals are networked to the election central agency. The central agency website is developed and voters and candidates obtain access to the latest election statistics without customization and personalization facilities. The interaction between the agency and end users is not allowed.

Stage 4: e-election is alive

In this stage, the goals of e-election are realized. It allows users to customize the election results for example by candidates. E-signature (based on PKI) exists and authentication is performed online. All election applications are integrated and are available at the election portal. Feedbacks and claims about the result are recorded online. Electronic relationship between the agency and end users exists, for example, via e-mail and Mobile SMS. In this stage, e-participation indicator will rise to the maximum level possible.

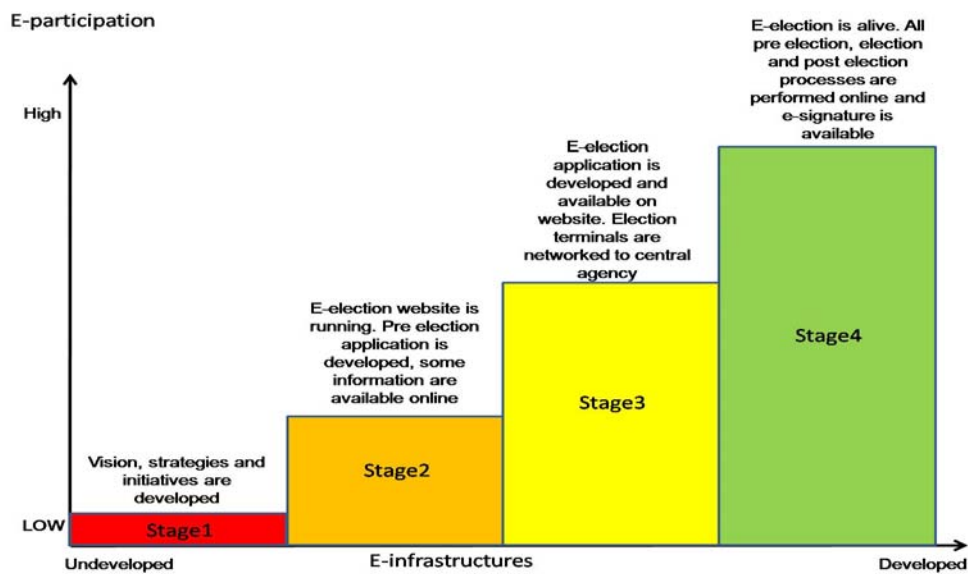


Figure 2. the four-stage model of e-election deployment

7. E-ELECTION MEASUREMENT

Putting e-election in practice has numerous benefits; as it could facilitate people participation in policy making and increase social inclusion. Therefore, election policy makers could pay specific attention to those groups in society that are at high risk of being excluded due to a wide variety of reasons such as age, gender, disability, literacy, and culture. E-election as a wide spread function of information and communication technologies in society will improve participation and inclusion [15 and 16].

Monitoring and tracking of e-election effects within society gives value information about participation rate of different groups in election. An election dashboard should be developed to facilitate measuring and monitoring functions. A main purpose of the e-election dashboard is to follow on a regular basis the evolutionary penetration of e-election in the society. The dashboard can also be used to follow and adapt the e-election policies in election holder organization. The access to the dashboard will be allowed for e-election key players to help those align their strategies considering the reality.

For this purpose, the definition of key performance indicators is crucial. Periodical evaluating and dynamic leveling of KPIs will help policy makers monitor e-participation and e-inclusion level within different groups in the society. Figure 2 shows very well the need for e-election metrics relating to the four stages of e-election diffusion.

The dashboard must cover the foundation subjects corresponding readiness state, which is very important in early stages of diffusion, and also cover the e-election process measurement and look after social and economic impacts of e-election.

We are unaware of any major organization, including international organizations working on e-election measurement. Therefore, certain basic indicators of e-election penetration are introduced below.

- | | |
|---|--|
| -Ratio of e-voters to | -no. of e-participants who are travelers, living abroad, |
| all voters | in hospitals, elder |
| all voters within disables | -total no. of e-participants |
| all voters within educated people | - technical infrastructure service level |
| all voters within rural regions | |
| all voters within urban regions | |
| all voters in geographical areas | |
| all voters of different literacy levels | |

Comprehensive analysis of information presented in e-election dashboard could help policy makers identify penetration pace and bottlenecks of movement towards e-society.

8. CONCLUSION

This article concentrated on strategic issues which must be addressed for designing the path from a conventional society to digital society via modernizing the election system. The issue can viewed from another perspective which is narrowing the digital divide via enabling and encouraging the public to engage in electronic interactions.

Having discussed the features of t- and e-elections, the article introduced driving forces of e-election; in reality, managerial concerns and focuses are significantly affected by the driving forces and motivations of e-election. In other words, a strategic plan must be formulated to align all elements important for the success of e-election design and implementation. To highlight the value of strategy formulation, the readers' attention is drawn to a fact: in some developing environments, on the one hand, e-election may be considered only as computerization of heavy manual tasks, e.g. counting ballots; on the other hand, public involvement in manual ballot counting may increase the acceptance of the election system. The strategy document is expected to address such issues in a systematic way and make a sound conclusion.

Further research is required on the social aspects of e-election which affects the pace and acceptance of the change remarkably.

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TO TAKE PART PARTICIPATING: POLITIKA 2.0

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ABSTRACT

This paper describes the project undertaken in the Basque Country by a group of bloggers working on a collaborative way for improving the possibilities of citizen participation in institutional decision-making processes. The experience started with a meeting among members of this group of bloggers and legislators of the Basque Parliament doing a reflection about how politics is made and what can be done to improve it. The experience involves the use of web 2.0 tools, with a view to sharing a reflection and creating a proposal for improving the services used by the Basque Parliament to favour institutional innovation based on Openness and Participation. The Parliamentary Chairwoman suggested, after the first meeting, to fix efforts and use the potential of the group to create three virtual workshops: 1- to propose a makeover of the parliament's website to open it to the citizens, 2- to identify needs and educational pills, courses on web 2.0 tools to transform parliamentary representatives and staff in 2.0 users, and 3- to run a course at the Summer University of the Basque Country. All of them with the aim of building, collaborating with the people who wish to contribute and commit themselves, improving a system that needs to adapt to another type of citizenship and other types of leadership, horizontal in form, with real participation possibilities and advocating the '2.0 Decalogue' presented by the Parliamentary Chairwoman in Bilbao to extend innovation to the political sphere. The name of the group of bloggers is Política 2.0 and group's activities and progress can be consulted in this wiki: www.politica20.wikispaces.com.

KEYWORDS

Political innovation, citizen Participation, eDemocracy, Politics 2.0

1. INTRODUCTION

One of the challenges that institutions are facing is how to best utilize the new Information and Communication Technologies (ICTs) in order to interact with citizens, and how to implement programs and projects in communities to make citizen participation a successful reality. The new ICTs offer many opportunities, which are gradually becoming a reality but which still need to be explored and experienced. Initiatives of this type are often connected with projects of a limited scope and depth (both politically and institutionally), and with regard to web technology most institutions remain entrenched in the web 1.0, which enables only a minimal level of interaction, and the institutions are therefore restricted to using the basic mechanisms of interaction provided by the Internet, as can be deduced from the Report Osimo (2007), which also shows citizen participation to be one of the key domains for exploitation, along with the provision of services for the front office and knowledge management, regulation and cross-agency collaboration for the back office.

There follows a presentation of the experience with the group of bloggers in a Política 2.0 named initiative of the Basque Parliament, a Parliament which since its beginnings in 2000 within has been creating, funding, and leading a variety of efforts, both theoretical and practical, in order to promote successful, real-life e-Democracy projects in the participating Institutions. The President Izaskun Bilbao Barandica coordinate the eDemocracy working group of The CALRE (2008) who apply The Openness model created

by this group in The Basque Parliament institution (see figure 6) and she drives this process of transformation trying to use this Decalogue which is as follows :

HUMANIZE. Act with and for people
SETTLE. Create partnerships, constructive relationships
APPROACH. Open up to society with transparency
SHARE. Perform networking for decision-making processes
CREATE JOINT RESPONSIBILITY. Involve through participation
SIMPLIFY. Improve organisation and languages
INTEGRATE. New leaderships: horizontal, female
EVALUATE. Measure results in order to improve
COOPERATE. Learn from others with humility
RISK. Believe in the value of change

And with the Politica 2.0 experiences described here, it is beginning to take its first steps.

On the basis of these principles, technologies play a facilitating role, breaking down spatial and temporal barriers and increasing the transforming potential of principles which, first and foremost, are a fundamental attitude and the essential condition for change.

The combination of the purpose, work and the contribution of the bloggers joined to the initiative with the path of the Basque Parliament, the receptivity and commitment of the chairwoman has put in action a cooperative model with three singular characteristics:

- One of the purpose is to do a diagnosis and to identify improvements to the actual participation services of the Basque Parliament, using at the same time open participation mechanisms. The legislators have been involved too.

- Other one is to think about the possibility to transform actual staff, civil servants and legislators, into 2.0 users. For that, the purpose is to analyze the potential of the 2.0 tools and create some educational pills to make this transformation possible.

And finally,

- The third purpose is to run a course at the Summer University of the Basque Country, which will permit people enrolled in this course to learn how to define strategies and manage projects in political innovation and related activities, share with course participants, analyze a list of Best Practices and have an overview of a selection of real-life initiatives.

These objectives have been fixed in a short and medium term. That will produce measured effects in the actual corporative attitude and culture of The Basque Parliament institution.

2. POLITICA 2.0 INITIATIVE

On 13 September 2008, a group of 43 bloggers attended a meeting between bloggers and politicians. This encounter, presided by the Parliamentary Chairwoman Izaskun Bilbao, was a first step towards reflecting on the future of participatory politics and attempting to foster change in the forthcoming electoral campaign. (see figure 1)



Figure 1. Photo of the encounter held on 13 September

However, at the encounter a proposal was made for 3 lines of work to be put into practice at another workshop held on 7 November.

- a Workshop for review of the Basque Parliament's web services,

- a Workshop for preparation of courses, educational pills, on Política 2.0 for MPs, and
- a Workshop for the design of a summer course in Política 2.0.

Meanwhile, a network was constructed (see diagram in figure 2) on the basis of individual and group blogs and tools as blogs, wikis, facebook, twitter, google groups, etc.



Figure 2. Logo of the Política 2.0 initiative surrounded by many key words, potential tools

The proposal advance and a new meeting has held on The University of Deusto the 7 November. A brief presentation was made of the activity undertaken in Política 2.0, the Basque Parliament recalled its proposal, and the work was initiated, in 3 groups, with each of the participants choosing the workshop most suited to their particular interests. (see figure 3)



Figure 3. Photos of the encounter held on 7 November

There follows a description of the objectives of each of these workshops:

2.1 Workshop for Review of the Basque Parliament's Web Services

The Parliament is currently involved in a website redefinition project, and it therefore wanted the bloggers to study its current website and make recommendations to aid an increase and an improvement in citizen participation and the approximation of institutions and citizens.

With a view to this, the team created had already carried out previous studies of the website and of the possible interaction between the current MPs, taking account many indicators to see the future evolution. The group participating in the workshop therefore contributed with general observations, and a debate was held on short-term improvements, with regard to design and accessibility of the materials, and proposals for improvement were agreed on for a new model of the Parliament's web services.

2.2 Workshop for preparation of courses on Política 2.0 for MPs

The aim of this workshop was to reflect on how to "familiarise" the Basque MPs with the concepts, values and tools of the web 2.0 and its application to Política 2.0. General concepts were dealt with, and also the importance of embarking on a process of change in corporate culture. A review was made of the possible

tools to be used and values put across, and of the possible synergies between web 2.0 tools and the Basque Parliament's current digital services. This was followed by reflection and discussion on the evolution from the actual "Office civil servant", that is an staff who use basic office applications, to the "web 2.0 civil servant", that can use usually collaborative web tools in the interaction among citizens, legislators, other colleagues, etc., and the new skills associated with public services work (see figure 4).



Figure 4. From Office civil servant to web 2.0 civil servant (Alorza, 2009) (bottom → up: to write, to calculate, to present, find, WEB, to read, to save, to listen, 2.0, to mix with, to talk, to coproduce)

2.3 Workshop for designing a summer course in Política 2.0 to be held in summer 2009

The aim was to design a summer course to be held in summer 2009 with the aim of disseminating the project. A possible approach to the course was discussed, together with a possible program and the opening of a wiki space in which the future course could be built up in more detail, including possible speakers, etc. (see the evolution in figure 5.)

Política 2.0

Curso-de-Verano-Politica-2.0

Integrantes del grupo: (los reunidos) Alberto Ortiz de Zárate, Iker Merodio, Jon Goikolea, Osane Lizarralde, Sergio Monge

Objetivo: Organizar un curso de verano de la UPV de título POLITICA 2.0 en el verano de 2009

Formato del curso: curso de 2 o 3 días de duración.

Fechas interesantes para celebrar el curso: principios de julio 2009 (alrededor de 4 julio, peligroso para atraer a Americanos al curso, que conviene contemplarlo, por eso de la fecha y porque muchos tienen las vacaciones por esas fechas, pero por otra parte que coincida por San Fermín puede ser también atractivo). Podría ser 8, 9 y 10 de julio, para finalizar el viernes.

Promotor: El curso será promovido y patrocinado por El Parlamento Vasco. Jon se encarga de reservar presupuesto para ello. (importante para que podamos traer a ponentes interesantes). (Habría que dar visibilidad también al grupo de Política 2.0 como ideólogo de la iniciativa)

Organización de los cursos de verano de la UPV: La organización del curso de verano tiene un planning y unos requerimientos que hay que ir cumpliendo. El 1º es que para el 26 de noviembre se presente un pliego del curso: título, objetivos, público objetivo, fechas, un director,... También ayuda en buena parte de la organización: difusión, contacto con ponentes, alojamientos varios, organización de comidas,...gestión del edificio, aula, inscripción de alumnos,... y un largo etc., pero que exige también estar encima. Más detalle en <http://www.sc.ehu.es/scrwwwsu/2009/cnormativa.html>

Doc presentado el día 24 de noviembre: [seminario-politica2punto0-081124.pdf](#)

Figure 5. Summer course on Política 2.0

In addition to these workshops, it was also decided that a new initiative should be set up: the Política 2.0 observatory, with the idea of it being operational by the March elections. This option is shown in figure 2, in the Actions “in progress” section.

3. THEORETICAL MODEL: THE SIX STEPS ON THE LADDER TO E-DEMOCRACY

This project operates in an environment sensitized with the idea of the transformation of the actual model of institution actuation and politics running. Therefore the Basque Parliament leads since 2003 a team destined to reflex to how can help new technologies to improve the democracy. (The guiding theoretical model has evolved over to the framework shown on Figure 6). This model has also been adopted as the eDemocracy model of the CALRE (2008), presented by (Lizarralde et al, 2008), which is available in the collaboration tool Local Digital Agenda (LDA, 2008), together with a self-diagnosis tool for eDemocracy and a set of good practices that has been compiled.

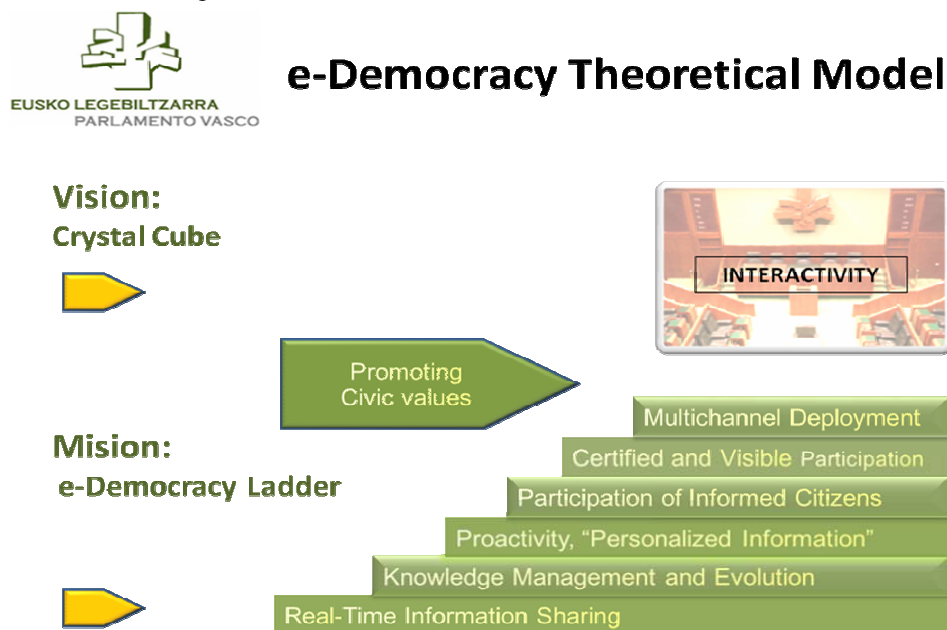


Figure 6. The six Steps to e-Democracy (E-Democracy /Openness theoretical Model) model)

The model promotes these steps to follow in order to promote, develop, and implement successful e-Democracy projects in public institutions:

- **Step 1: Real-Time Information Sharing.** Publishing of e-Democracy contents and implementation of “search engines” to locate and retrieve these contents in housed in four databases in the Basque Parliament. Each file of contents is updated on a regular basis (daily and weekly), contains both text and graphics, and it is supported by multimedia devices. Each search engine features a four-level filter to optimize finding of desired documents in those four databases. In this step, it is necessary to know the institutional technical terminology.
- **Step 2: Knowledge Management and Evolution.** “Search engines” are made available to search for documents, papers, records of debates and other materials without needing to know about the procedures and doings of a Parliament. Access to those materials is guided through “key words”, “themes”, names of representatives in a Parliament, etc. The possibilities to find an item are increased.
- **Step 3: Pro-Activity, “Personalized Information”.** Information is made available to a user (i.e., a citizen, an employee or representative at another Parliament, etc.) according to a list of themes and topics specified by the user himself/herself. A weekly electronic message alerts the user on developments associated with a topic of interest and makes available direct access to files with relevant contents, including space on a

platform (e.g., space on a parliament's web page dedicated to providing this personalized information), and a private conversation with his/her representative in a Parliament. The term “customized information” is also used here.

- **Step 4: Participation of Informed Citizens.** The service Parte Hartu (a term in the Basque Language, Euskera” that means “Take Part”, or “Participate”) insures that the comments and opinions contributed by users (citizens), as well as those contributed by users of Zabalik (another web-based service provided by the Basque Parliament, as discussed in the following sections), are made visible and communicated to other users. Similarly, answers contributed by representatives in a parliament are made available to users of this service. Eventually this service will be extended to include electronic authentication of service users. It should be noted that user of Parte Hartu generally requires that users well informed, often knowledgeable of statistics related to a theme or topic, compared to users of the Zabalik service where, by design and purpose, its users may have only preliminary information about those topics and themes.

- **Step 5: Certified and Visible Participation.** If the user (i.e., citizen) so wishes, his/her contributed comments, ideas, and recommendations made through the Zabalik service can be made public. Eventually this service will feature certification of the user’s identity via digital means.

- **Step 6: Multichannel deployment.** The model provides these guidelines for generating digital information and participation services, but it also includes research for reducing the digital gap and using multiple channels, including those that are most widespread within the population.

General context: this set of principles is applied within a context of the promotion of values such as co-responsibility and co-management, by activating programs for dissemination, value training and social awareness-raising.

At this point, The Basque Parliament start the redefinition process of these actual web services and gives the word to the Política 2.0 bloggers to collaborate in the creation of the next step.

4. MODEL IMPLEMENTATION

Implementation of the theoretical model presented above is possible through the use of a select set of the new information and communication technologies (TICs), and services like “Zabalik” (Zabalik 2007), “Parte Hartu” (Parte Hartu 2007), “ParlamAuto”, (Parlamauto, 2008), that are described in the following points.

4.1 The “Zabalik” Project

Zabalik is a free-of-charge weekly service offered by the Basque Parliament to citizens. Zabalik in Euskera, the Basque Language, means “open”. Via e-mail, this service offers citizens and civic organizations a variety of information on documents available to be downloaded, announcements of political debates, and project initiatives to take place in the Parliament. Along with an announcement, an URL is made available so that users can gain access to and download related documents and videos.

Some actual data: 2500 permanent subscribers, 10000 different users.

4.2 The “Parte Hartu” Project

The Parte Hartu Project (Participate in the Basque Language) was fielded in January 2007 and since then it has been providing a “space” for citizens to place questions to individuals and groups of representatives in the Basque Parliament on any topic or theme. These questions are posted on a space in the portal web of Basque Parliament dedicated to promote citizen participation. Answers to those questions are also posted on the same space. Parte Hartu offers the possibility today of gathering ideas and suggestions presented by citizens and classifying these into any one of 20 categories (e.g., youth programs on civic values, exchange programs with other parliaments, forums with citizen and parliament representatives, etc.)

In only a few short months since its implementation in January 2007, the Parte Hartu service has received close to 100 suggestions and recommendations by citizens, even though there was relatively little activity happening in the Basque Parliament for that time of the year, a most welcome set of results. As activity in the Parliament picks up, citizen participation in both Zabalik and Parte Hartu should also pick. We add that “open source code” is being used to implement Parte Hartu.

4.3 The ParlamAuto Project

With both the Zabalik and Parte Hartu services already fielded and going, a next project that the Basque Parliament has put in motion is the ParlamAuto project. As the name implies, a bus houses a number of PCs and supporting equipment in order to “go from door to door” in towns and cities sharing e-democracy concepts, values, and day-to-day applications with young, adult, and senior citizens.

The Objectives of the ParlamAuto were to share with citizens general information about day-to-day activities, functions, and processes that take place in the Basque Parliament, and to promote those digital services that enable and encourage citizen participation and that are made available by the Basque Parliament through the Internet.

Politica 2.0 is a new initiative bloggers to make a collaborative reflection, define a possible next step and identify potential new projects.

5. CONCLUSION

Innovation in politics is much more than designing and financing innovation policies geared towards encouraging innovation in the private sector. Innovation in politics means responding to social changes and it requires a firm commitment to change (Macintosh, 2006), institutional transformation and organisational culture (Aibar, 2007); providing good public services and creating fair laws is of paramount importance, but so is changing the relationship between representatives and those represented. The mediating role played by the politicians will change, requiring different skills and capacities. Creating 2.0 politicians and citizens is a challenge for society, and it is a challenge that must be taken on by the institutions. Change is already upon us, and if it is not the institutions who demand it and lead the demand for innovation, it will be the citizens (O’Callaghan, 2005). In the Basque Country 2.0 citizens groups are making an effort to turn the abstract ideas into a specific process based in the participation with specific objectives.

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A RESEARCH MODEL TO SUPPORT THE SOFTWARE DEVELOPMENT MANAGEMENT FOR THE BRAZILIAN GOVERNMENT

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ABSTRACT

This article aims at presenting a research model that supports Software Development Management used by several Brazilian government institutions. This model intends to integrate organs of government, public-private partnerships and universities. Currently, this model has been used in software development projects of the Ministry of Planning, Budget and Management, the Defense Ministry and in Brazilian public-private institutions. The expectation is that, as a result of using this technology management standard, there will be more facilities to suppliers integrate the government business portfolio in a coordinated manner, joining the organizational and technical University support with Government and Society, respectively. The proposed model is composed of free tools and has, as main background, the development framework MDA (Model Driven Architecture), supported by the Service-Oriented Architecture (SOA) and a project management software called Cronus. Once this standard is adopted to develop software, it is possible to ensure that there will always be a continuity plan for monitoring each technology effort undertaken by the government. In the present work, in addition to the brief description of the suggested model, several successful stories, learned lessons, the currently carried out struggles and the future challenges will be presented.

KEYWORDS

Government Software Development, Software Development Models, Project Management, Model Driven Architecture.

1. INTRODUCTION

Many studies point out the need of developing linkages among universities, government and industry to lead to successful and mutually beneficial outcomes for all of them. (Bhattacharya and Arora, 2007). Brazilian government has several agencies that have different necessities, including the Information Technology development. Depending on the variety of agencies and software providers, there is a tendency for decentralization in the use of methodologies and distinction of technologies applied to these tools.

A modern, integrated and efficient government needs equally modern, integrated and efficient systems, working in a way that is integral, safe and consistent with the public sector. Brazilian Government has significantly increased the use of technological solutions to control its intergovernmental processes (ePing, 2007). Recently, despite the technological benefits and the satisfaction of organizational customers and society, the use of technological solutions has shown the necessity for reorganization in the matrix which supports software development projects. For instance, the Brazilian Government has been setting up an increasing number of web access locations to afford virtual support to its citizens (Maciel *et al*, 2005) and this type of event needs better development orchestration.

It is known that investment on Information Technology (IT) has impacts on different stages of business operations (Chen, 2006); then, institutions tend to increase their organizational and technical investments when they find a particular form of integration among their projects through Information Technology (Rai, 1997). Other authors affirm that organizational performance is higher when they maintain a singular strategic focus as opposed to a multi-focused strategy (Tallon, 2007). Therefore, the lack of a process to

manage the Information Technology portfolio may hinder the effectively dissemination of knowledge, acquired by a number of teams through the organization.

According to Niehaves (2007), the innovations of the public sector have been widely studied from a managerial (new public management) as well as technological (electronic government, eGovernment) perspective. In this perception, decentralization reforms open up innovation potential for local governments, by which means the central government still holds strong influence on innovation and diffusion processes; then, it is possible to create paths of eGovernment and public management innovation as a result.

Furthermore, the use of distinct technologies and, frequently, the use of private sources systems, that is, “closed code software”, deny flexibility when the suppliers need to be changed. This situation causes a damaging dependency and undermines the continuity plan of IT services. The primary focus has always been to find a set of “free” technologies which are able to support the software development quickly and consistently, promoting platform independence, and also integrated to the government model of IT management.

However, it was observed that this motivation was only the first step. Indeed, the imperative circumstance was to create a Software Development Model Management that is able to take into account some special features, such as dealing with political issues, inserting private partnerships, managing the technical potential of professionals from universities, and also using only free technology.

In order to minimize these related gaps, a research on this model creation was proposed to the Brazilian government. This initiative has currently been implemented in several federal institutions, taking careful to ensure that political, technological and management aspects shall be discussed and integrated in their proper spheres of action.

In the following sections, the details of the research, the gained experiences up to now, the actions of circumstantial corrections, the barriers found and the challenges ahead will be presented.

2. RESEARCH AS THE SUPPORT FOR THE SOFTWARE DEVELOPMENT MODEL MANAGEMENT

The discussed model is based on 15 years of experience in developing software solutions to the Federative Republic of Brazil. During this period, roughly 500 professionals worked on several subjects and, nowadays, there is a permanent team of 150 professionals, consisting of doctors, teachers, graduate and undergraduate students (not only computer science professionals, but also designers, production engineers and other specialists), who work in maintaining and creating new tools for several Brazilian government organs.

The Model Management resulted from the necessity in supporting the expectations of public and private sectors with human resources and technology from the University. In these years of experience, the current model has been able to generate quick and innovative solutions as well as to hold University talents and implement new technological trends for the private sector.

The model is based on 3 pillars: Research, Extension and Management, as shown in Figure 1. The research is the core that generates, evaluates and validates new technologies for the whole group. It is important to note that researches are often motivated by the requirements of internal group's clients.

Thus, the nucleus of Extension creates the necessity and the core of Research provides specific contributions to satisfy the requested demand. The mechanism that ensures the resources and information management, the appropriate communication and the orchestration between demand and development is the core of Management.

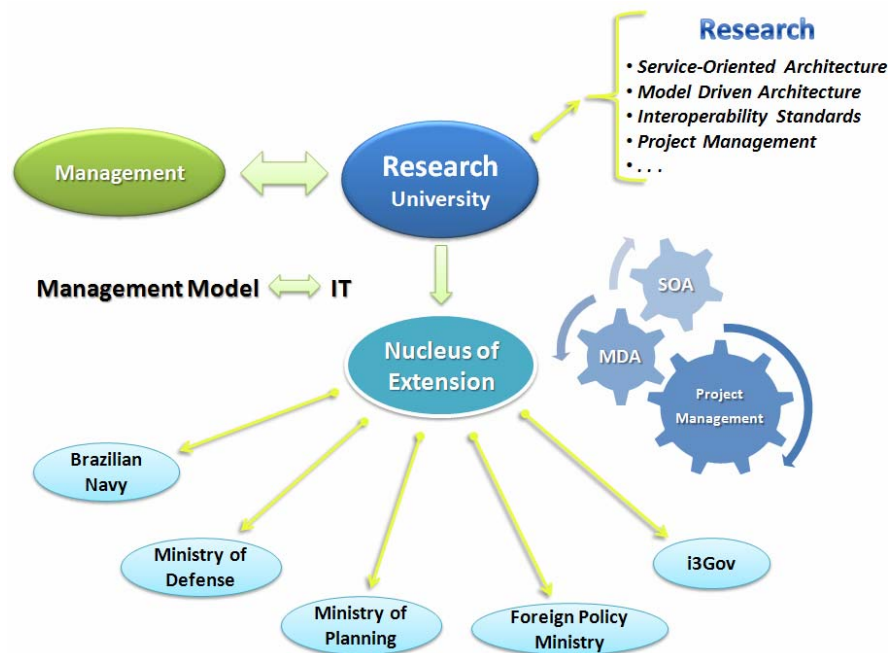


Figure 1. Software Development Model used in several Brazilian Government projects

The nucleus of Extension concentrates the biggest challenges of this model once this nucleus is responsible for managing several IT development projects. Over the past few years, a methodical process was created to manage the staff and to keep updated the MDA framework, which supports the development for several government systems.

The managerial model, illustrated in Figure 2, considers as labor force the professionals from the University whose team is composed of very talented individuals who have high productive potential and only feel encouraged by interesting tasks. At first, it may seem fantastic to have only very productive and enthusiastic professionals in a staff; however, it is difficult to ensure that the activities will be challenging for all of them since many developments are simple routine. Moreover, these people are often invited to work in "external businesses" and multinationals, which makes this resource management too complex.

Thus, a management and development structure was established to deal with this. As shown in Figure 2, the Management quadrant contemplates the Coordination and the support from the Project Management Office (PMO), when necessary. Coordination is responsible for closing the business agreements and to manage the political factors that appear during the project. The PMO is mainly responsible for holding Human Resources, to ensure updated the strategic documentation of each project, to manage the negotiation knowledge and involved project risks, to communicate and share strategic information and to scrutinize the projects financial viability. Accordingly to PMBOK (2004), an internal Project Management Office (PMO) gives organizations the ability to achieve consistently successful results across their entire portfolio of projects, creating a foundation that can turn project management into a competitive advantage.

In the Development quadrant, there are two types of team: Framework Support Staff and Application Development Staff. As previously mentioned, these teams are composed of Doctorate, Master and Graduate students; therefore, they are technically excellent. The Support Staff is responsible for the Framework maintenance and evolution. This team works under construction of reusable components and, due to the recently undertaken efforts, nowadays, 90% of the application's source code is automatically generated from the MDA Framework. The last 10% (design, interface adjustments and specific developments) are realized by the application development team.

Differently from the Support Framework team, the Application Development staffs are more itinerants and have practical rigid hierarchies. The so called Development Team always has a Project Leader and up to three Developers (programmers). The Leader is a professional with more experience, generally, a doctorate student, while Developers can be undergraduate students or master's degree students. The main Leader's responsibilities concerns delegating tasks, asking for results and updating the development situation in the

internal tool of project controller. Besides, the Project Leader must communicate to the team the Framework necessities of improvement. It is important to mention that all implemented evolutions in the Framework are released to other development staffs. This cautious guarantees a collaborative environment and avoids damage team competitions.

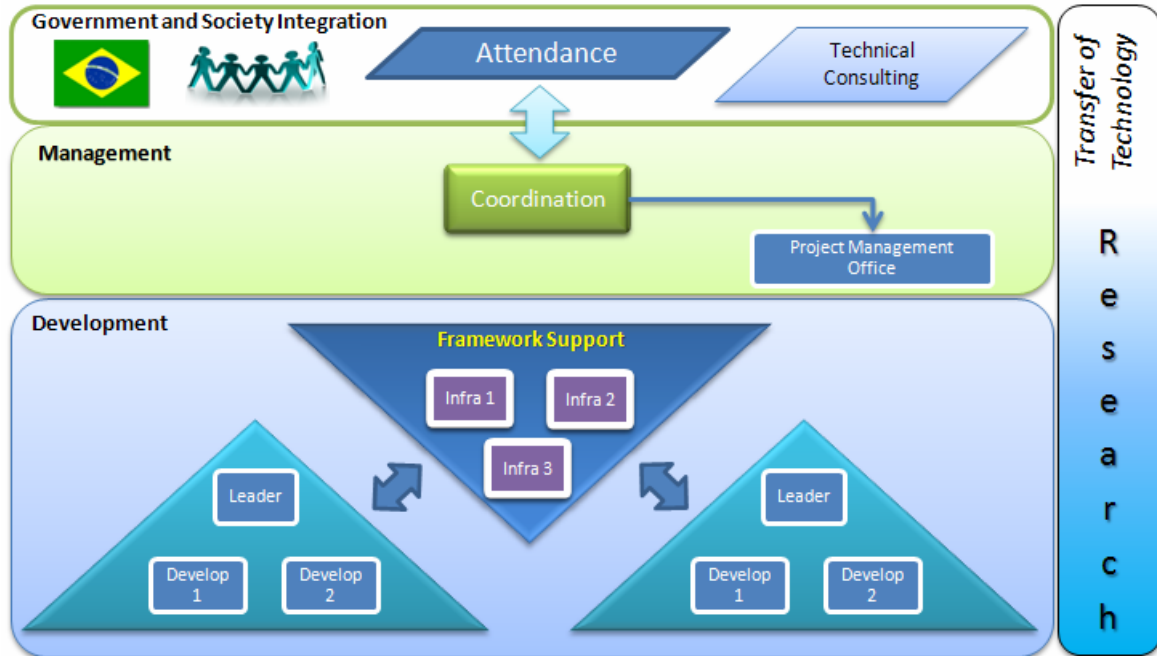


Figure 2. Project Resources Management Structure

The Research quadrant has, at least, two functions: to disseminate the project's acquired knowledge to the scientific community and to ensure the transfer of technology to the government organs and technical consulting as well as to all companies involved. In this case, the Coordination works as mediator through interactions among Government, Industry and University. There is always an Attendance team to support and to guarantee the communication between Government and Society.

It is useful to remember that the project communication's flow is based on the matrix of responsibilities, established by the Coordination at the beginning of the project, but it can be adjusted by the PMO when differing from the standard adopted by other teams. The political dialogues are conducted directly by the Coordinator (Management quadrant); however, leaders and the Framework supervisor are often involved in such type of meeting. This scenario ensures that requests for changes are comprehended among all those involved, avoiding future reworks.

2.1 Technological Features

The managerial structure presented in the previous section has a core set of technologies and methodologies which supports Model Driven Architecture (MDA), Interoperability Standards and Project Management, Programs and Portfolios, including Service-Oriented Architecture (SOA). For each methodology / technology there is a subset of mechanisms and tools "free of platform" to ensure flexibility, portability and transparency in the software implementations for the government.

The Service-Oriented Architecture (SOA) concerns the development of applications in which one or more services, possibly available through Web Services, are orchestrated to achieve business goals. Overall, modern businesses and governments implement their workflows based on web services centric architectures (Nowak *et al.*, 2007). The development of several standards and communication protocols and also the information exchanging (XML, SOAP, etc.), associated with workflow applications implemented through Web Services (available on the Internet), allow that such applications may not only integrate areas of the

same organization, but also enable the integration and cooperation between different companies and organizations, which generates a continuous gain in productivity. By joining this unprecedented degree of interpersonal communication with the workflow application based on the web, the result is an entirely new platform for the most varied forms of collaboration.

The MDA framework is a platform in which the business issue is faced in a high level of abstraction, during software development. Actually, the whole development, including the implementation is model oriented. In the MDA framework, the source code is generated from models derived by the system's requisites analysis, providing that, at the same time, documentation and implementation keep synchronized and updated. The source code is engendered through transformation templates, applied to model in accordance with the decisions made during the system's analysis stage. Thus, it is possible to ensure that implementation will faithfully follow the defined architecture. As a result, systems more robust can be generated by the use of this methodology, which also provides greater facilities for their maintenance and better quality.

The so called Framework MDA is based on an open source framework named AndroMDA, which uses UML models, generated through CASE tools and several plug-ins named "cartridge" to create personalized components, that is, the system's source code (Marzullo *et al*, 2008).

These components can be generated to different platforms, such as JEE (java), .net (C#), PHP, HTML, etc., besides generating applications for a wide variety of existing data bases (Postgres SQL, Oracle, SQL Server, among others), which makes the development flexible and independent of platform. The MDA framework extends the plug-ins available in the AndroMDA and incorporates a number of new plug-ins that allows increasing the development team productivity and a rises the final product quality.

Cronus is a Project Management tool that strongly operates in the project task control. The software was constructed by the University students and, because of this, is considered an open source system in Brazil. Cronus has simple and intuitive interfaces and assists IT professionals during the preparation of task executions through the creation of tasks and micro tasks that must be realized to conclude the project activities. Cronus allows the integration with other project tools in order to import their activities and the main goal of Cronus is to work as a task oriented software.

The task oriented is an important component to the management, which complements the approaches used in the frameworks, such as PMBOK, CMMI and o Mps.Br, whose highest level of detail is typically the task (PMBOK, 2004; Weber, 2007). Therefore, no one in the development team works without allocating their effort (in hours, for example) on a task, which is previously classified by the team leaders in control accounts, such as development stage, artifact, type of activity, among others. Thus, team leaders have enough data and information in real time, not only to control and re-plan the project (with a high level of detail), but also to improve the software processes and better practices adopted.

2.2 Relationship with Government, Enterprises, University and Society

As previously mentioned, this model of work has run excellently among government, university and some private enterprises. The next Brazilian Government challenge is to formalize the insertion of Micro and Small Enterprises (MSE) in this Model of Management and Software Development.

Many studies denote the importance of government and society integration. For instance, Bhattacharya and Arora (2007) have investigated industrial interactions in science and 'applied science' departments of universities in India. In their study, the authors found that specific government initiatives like creation of special centers to facilitate interaction with industry were observed in the majority of the Indian universities, and the government had taken important initiatives to strengthen the university-industry link.

In the context of this work, through the use of private-public partnerships, Brazilian enterprises may participate of this initiative as "clients" of the proposed Research Model and, on the other hand, as Government solution "suppliers". The idea is quite simple: the University provides empowerment to MSE, which, in turn, will be able to realize IT services to Brazilian Government. It means that, once "certified", these enterprises will be officially able to develop software for Brazilian Government. This scheme increases the number of qualified enterprises to work with the government and also ensures that Government and Society keep receiving flexible and quality solutions, in a recognized and free standard.

Figure 3 shows the joint participation between University and MSE entered in the Model of Software Development and Management for the government. As it can be observed, government and society can use

national technology to develop standardized software in free platform. Based on the presented model, public-private partnerships shall be leveraged because there is enough standardization to maintain the quality of developed services and keep it available to society.

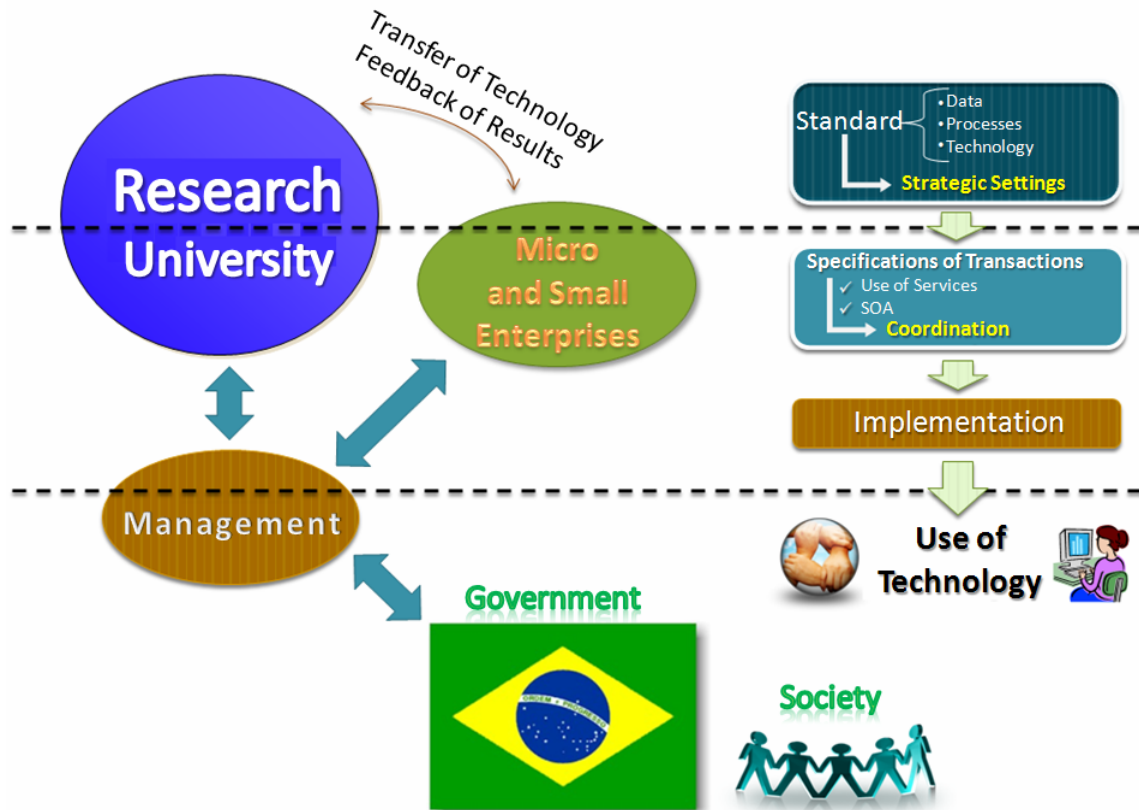


Figure 3. Interaction among University, Enterprises, Government and Society

Studies reveal that science, technology, and industry involve different logics, and therefore pressures for reorganization are continuously generated at the interfaces between these developments (Dits & Berkhout, 1999). Reorganizations can be smoothened informally, that is, through social relations among industrialists, scientists, and engineers, or regulated formally (Granstrand, 1999; Jaffe & Trajtenberg, 2002; Van den Belt & Rip, 1987).

This Model of Research and Management maintains the University as regulator of data, processes and technology; however, there is enough space for interaction with Enterprises. Therefore, the University's key role will be the technology transference while these Enterprises will suggest innovations and joint work in this direction.

3. CONCLUSION

The function of organized knowledge production and control systems for the government and society has changed structurally in the last years. The focus on innovation changed the position of universities (Leydesdorff and Meyer, 2003). Universities had to follow suit by rethinking their research portfolio and beginning to integrate better enterprises, government and society.

This work presented a research Model in order to support software development management in Brazilian government and private institutions. This Model intends to integrate organs of government, public-private partnerships and universities. In this direction, necessities of Brazilian government have been comprehensively studied from a managerial as well as technological perspective. As a result, various

academic projects productively contributed to analyzing integrative demands and their technological processes in the Brazilian government from specific perspectives.

Based on the Model proposed, the University group has engaged in activities to support continued development of the IT work force and the sharing of best practices. By incorporating industry and academic experience for managing technology and information management, the Brazilian Government has made major improvements in managing information systems to achieve the greatest gains in productivity, services and results for the society. This circumstance motivates the insertion of enterprises in the group of government IT suppliers.

Once certified in the proposed Model, Micro and Small Enterprises can make specifications of transactions and implement technological solutions according to the standards established by the Model proposed. The management of these demands and the government integration is done by the nucleus of Management. As a result, Government and Society can use cutting-edge technology designed for national industry and free of platforms. The expectation is that the applicability experiences, allied to enterprises insertion, will lead this Model to a national pattern of software development, ensuring the high level of quality and innovation undertaken up to now.

The Model proposed here can be compared to the entrepreneurial university (Clark, 1998; Etzkowitz, 2002) – one which extends its missions in higher education and academic research to assume the role of stimulating economic innovation in the environment. A new role pattern for academicians would thus be required. Thus, the future challenge is exactly to stimulate a large number of Brazilian universities to adhere to this Model and try to do experiments with foreign universities, enterprises and other countries.

Nowadays, strategic investments are in progress based on this Model. The group of main clients includes Brazilian Navy, Ministry of Defense, Ministry of Planning, Budget and Management, Foreign Policy Ministry and Brazilian public-private institutions, which points for a good acceptance of this Model. As further work, while the e-government domain will be further examined, we plan to evaluate the Model in terms of its financial performance and enterprise usability on proposed technologies. Besides, we intend to evaluate the Model in other countries, through bilateral IT projects.

ACKNOWLEDGEMENT

This research was funded by Brazilian Ministry of Planning, Budget and Management, CNPq and COPPETEC Foundation.

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BARRIERS TO ORGANIZATIONAL INTEROPERABILITY – THE NORWEGIAN CASE

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ABSTRACT

The eSociety strategies, the growth of internet access in general, and the development of eGovernment in particular have a remarkable impact on the development of the information society. This development has brought about a broad range of new issues and challenges, among these, those of interoperability of systems and services. One area, in which barriers are common, yet not fully understood, is organizational interoperability. In this paper we present results from empirical research exploring such obstacles. The findings are based on 15 semi-structured interviews, and organized in ten categories of barriers to organizational interoperability.

KEYWORDS

Organizational interoperability, organizational barriers, collaboration, eGovernment.

1. INTRODUCTION

The eSociety strategies (e.g. the i2010 – A European Information Society for growth and employment, 2005), the growth of internet access in general, and the development of eGovernment in particular have a remarkable impact on the development of the information society. Clearly, the strategies bear fruit, and new electronic services to citizens and businesses keep evolving. Governments all over the world are offering a rapidly increasing number of on-line services to businesses and citizens, often on a so called 24/7-basis (24 hours a day, 7 days a week). One indicator of this is the percentage of enterprises which use the internet for interaction with public authorities; the figures are continuously and rapidly increasing¹. In Europe, the level was approximately 50 % in 2004, while in 2007 this share had increased to around 65 %. This development has brought about a broad range of new issues and challenges, among these, those of interoperability of systems and services.

The common model to describe the sophistication level or interactivity of electronic services must, as we see it, be expanded with additional levels in order to fully describe the required maturity of interoperable services. The current model as presented by Wauters et al. (2006), and the model in the Norwegian white paper STM17 (2006), are composed of a zero-level and four levels of interaction, or service and content availability on-line. Both stage models are drawn in Figure 1. Many governments are, in fact, reaching the first level of interoperability as illustrated in Figure 1.

One of the challenges of the development of advanced electronic services is interoperability. According to the upper levels of maturity or sophistication, several suppliers of information and basic services need to collaborate in order to deliver the required services. This requirement challenges the organizations involved in the collaboration in many different ways. Above all levels of interoperability, there are high-level policy issues which concern objectives (e.g. efficiency, effectiveness and efficacy) and strategies at governmental and intergovernmental levels. Below this, there are interoperability issues of both technical, semantic and organizational character.

First, there is the very basic level of technical interoperability which includes such topic areas as physical connections, common protocols, definitions of data elements and interfaces, and documentation of system functionality. Semantic interoperability begins to exist when we move from presenting information and exchanging it between computer programmes, to combining it with other information, processing it and using it in a *meaningful* manner in a given *context*. Second, the organizations have to be both *able* and *enabled* to

collaborate. This is where organizational interoperability enters the scene. In order to reach the sophistication level of full, transparent interoperability (cf. Figure 1), a number of obstacles have to be removed. One area, in which barriers are common, yet not fully understood, is organizational interoperability. In the remainder of this paper we present results from empirical research exploring such obstacles.

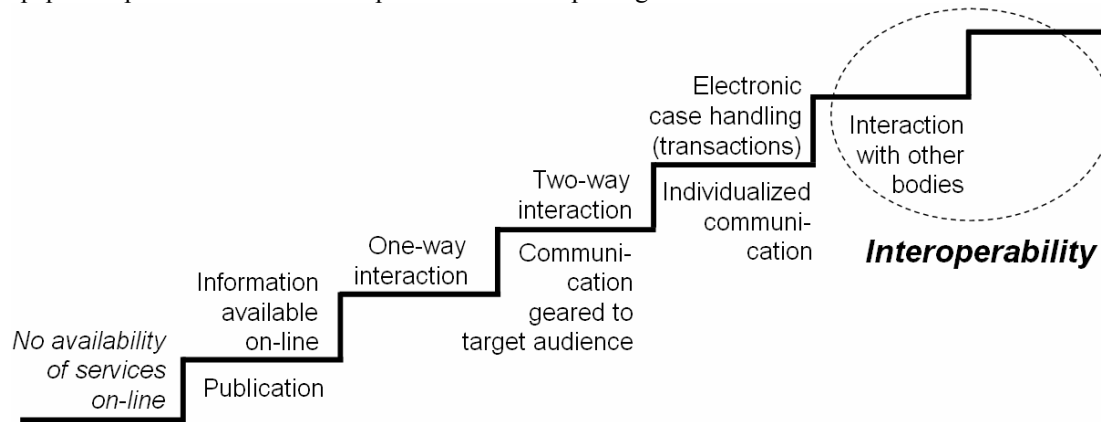


Figure 1. Above the stage-line the sophistication stage model of (Wauters et al., 2006). Below the stage-line, the service stages as described in the Norwegian white paper (STM17, 2006).

1.1 Definitions of Organizational Interoperability

Organizational interoperability is rather hard to define precisely. However, several descriptions have appeared in recent publications. Together, these give a sufficient “definition” of what this is all about.

According to Finetti (2003) organizational interoperability deals with modelling organizational processes, aligning information architectures with organizational goals, and helping these processes to cooperate. Interoperable Delivery of European eGovernment Services to public Administrations, Businesses and Citizens (IDABC, 2004) characterizes organizational interoperability in its European Interoperability Framework Version 1.0 as follows: “This aspect of interoperability is concerned with defining business goals, modelling business processes and bringing about the collaboration of administrations that wish to exchange information and may have different internal structures and processes, and it aims at addressing the requirements of the user community by making services available, easily identifiable, accessible and user-oriented.”

In Version 2.0, the interoperability model is divided into several layers, of which the organizational and legal levels together address issues that we place in the category of organizational interoperability. The latter is said to concern a “broad set of elements of interaction, including business processes, business interfaces such as email, web portals, etc., business events within and between administrations, and “life” events, involving external parties: businesses and citizens. In practice this means the seamless integration of business processes and the exchange of information that they manage between the organizations. Organizational interoperability occurs when actors agree on the why and the when of exchanging information, on common rules to ensure it occurs safely, with minimal overhead, on an ongoing basis, and then draw up plans to do all these things, and carry them out.” (IDABC, 2008).

Finally, the ATHENA-project (2007) has identified 31 interoperability issues. These are classified according to business management, process management, knowledge management, information management, service management and data management. A large number of the 31 issues in all categories go under the general heading of organizational interoperability.

1.2 Known Obstacles to Organizational Interoperability

Organizational interoperability can be seen as an important enabler of all interoperability, semantic as well as technical. Common goals and practical agreements have to be in place before any collaboration can take place. Organizational interoperability issues are therefore gaining increasing interest. Among many important publications, there are several that discuss *barriers* to organizational interoperability, i.e. why it does *not*

happen to the extent that is intended and desired. There are, of course, also good examples of interoperability on all levels. As far as Norway is concerned, Altinnⁱⁱ (“AllIn”; a common internet portal for public reporting), NUCASⁱⁱⁱ (the Norwegian Universities and Colleges Admission Service) and Digital Norway^{iv} (a collaboration that enables access to geoinformation data and services owned by producers at national, regional and local level) can be mentioned as examples of best practice where systems and services are based on interoperability on all levels (Figure 2). However, there should be more. Thus, our research question is: “Why isn't there?” Below, we refer to research work that has contributed to an understanding of this lack in a remarkable manner. In Chapter 2, we will present our own findings that complement these.

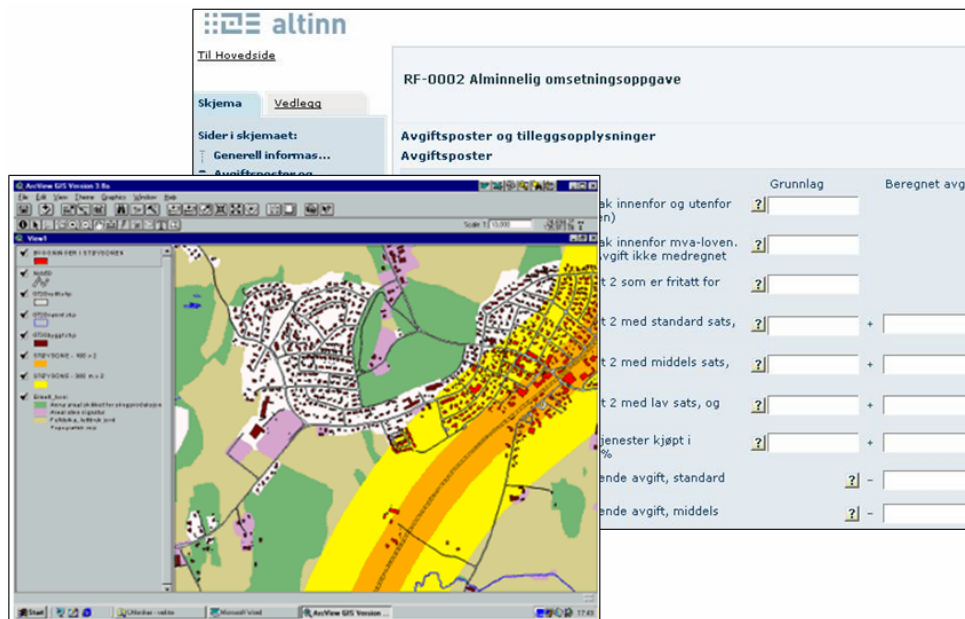


Figure 2. In Norway, Altinn (“AllIn”) and Digital Norway are examples of excellent collaboration between different information owners and service providers to produce integrated electronic services to businesses and citizens, based on fully transparent interoperability between several service providers

Eynon et al. (2007) have identified seven barriers to eGovernment: “1. Leadership failures, which result in slow and patchy progress to eGovernment, 2. Financial inhibitors limiting the flow of investment to eGovernment innovation, 3. Digital divides and choices, where inequalities lead to differences in motivations and competences that constrain and fragment eGovernment take-up and fail to address particular user needs, 4. Poor coordination across jurisdictional, administrative and geographic boundaries that holds back eGovernment networking benefits, 5. Workplace and organizational inflexibility impairing adaptability to new networked forms of information sharing and service provision, 6. Lack of trust heightening fears about inadequate security and privacy safeguards in electronic networks, and 7. Poor technical design leading to incompatibilities between ICT-systems or eGovernment services that are difficult to use.”

Beckers (2007) has also identified seven interoperability problems, five of which seem to address different aspects of organizational interoperability. These are: “1. Administrative interoperability, containing conflicting, exclusive or overlapping jurisdictions and accountability, 2. Legal interoperability, meaning different legal regimes with conflicting rights and obligations, e.g. in relation to privacy and safety regulations, 3. Operational interoperability, i.e. different working processes and information processing, routines and procedures, and 5. Cultural interoperability, addressing conflicting organizational norms and values, communication patterns, and grown practices.” All these authors suggest strategies to overcome such barriers. We return to these in connection with our own findings in Chapter 2.2.

We regard further exploration of barriers to organizational interoperability as a key issue in the enterprise of approaching sophisticated eGovernment. In the remainder of this paper, we report from our own empirical studies related to obstacles to organizational interoperability. In the Semicolon-project^v (cf. also Acknowledgements), semi-structured theme interviews were carried out to provide a better understanding of barriers to organizational interoperability, and to suggest solutions to these.

2. BARRIERS TO ORGANIZATIONAL INTEROPERABILITY

2.1 Method

In September-December 2008, 15 semi-structured interviews were carried out in the Semicolon-project sites and other relevant organizations. Each interview lasted from one to one and a half hours. The interviewees were recruited among middle to upper management and senior advisers with professions or careers close to but not necessarily within the ICT-departments of the organizations. The interviews were targeted to inform the Semicolon-project, as well as to provide information about experienced and practical barriers to organizational interoperability. This technique was used in order to collect qualitative data by setting up an interview situation which allowed the respondents to talk freely about their opinions on and experiences with the subject (i.e. organizational interoperability). Open-ended questions were used, the wording of which was practically identical for all respondents. The main themes, including a number of sub-themes, were:

1. "What do you understand by organizational interoperability, or how would you describe it?"
2. "What promotes organizational interoperability in general?"
3. "What retards organizational interoperability in general?"
4. "Do you have any examples of best practice within organizational interoperability?"
5. "What kind of measures or what kind of initiatives would boost organizational interoperability?"

The material is highly qualitative. The interviews were transcribed into structured schemes, expressing the main statements made by the informants. In the next chapter, these statements are presented in ten categories of findings. No weak indications are included in the findings: a minimum of one third of all informants must have clearly indicated the existence of a particular barrier in order to be included in the findings. To be included in the findings, at least one third of the informants must have explicitly pointed at a particular barrier. Approximately one third of the barriers were mentioned by slight majority of informants. Because of obvious anonymity reasons, no citations are provided.

2.2 Findings

Below, the main findings from the interviews are presented. An attempt has been made to cultivate the categories of findings. However, the categories are undoubtedly intertwined, such as those presented in Chapters 2.2.5 and 2.2.6. The context of the informants' statements was, however, clearly different, and thus separate categories were defined. There are also many individual statements and comments that are not included in the presentation of the findings. The collected material is large, and therefore we have chosen to systematize the findings in categories that several or many informants identified as barriers to organizational interoperability.

2.2.1 Competency Gaps

As described in Chapter 2.1, organizational interoperability is based on a good understanding of business processes, and models of these. In many organizations, modelling of business processes has not taken place. Business is done "as usual", and changes occur more or less on an ad-hoc basis. In order to integrate the business processes of two or more organizations, models of these processes are obviously required. Models, in turn, are necessarily based on a detailed knowledge of real tasks, procedures and routines. These have to be analyzed and put into a frame of formal descriptions, i.e. models. Poor knowledge of business processes represents a true obstacle to organizational interoperability. Equally poor is the ICT suppliers' knowledge of the business processes of the customer, in this case public organizations. Thus, their systems and solutions do not correspond to current interoperability needs or future opportunities. The third instance of poor competency often occurs at the operative level of organizations. Digital illiteracy and resistance against new applications of ICTs reduce the potential that interoperability through uses of modern technologies could offer.

2.2.2 Lack of "Measurables"

The informants indicated clearly that instruments for measuring organizational interoperability are completely missing. This lack of proper instruments has a negative impact on both planning, execution and evaluation of organizational interoperability. In the planning or re-engineering of business processes, the description of organizational interoperability goals suffers both from the high level of abstraction and the difficulty to quantify the level of ambition. Performance indicators, score cards or barometers for organizational interoperability are missing.

erability are clearly missed. In this connection, economic indicators that describe the effects of successful interoperability are also called for.

2.2.3 Money Talks

Several informants pointed at the fundamental power of money, and this manifests itself in a number of different ways. In Norway, governmental departments and agencies operate according to a strict fiscal sector principle. Each department takes care of its own business, and collaboration in general and interoperability issues in particular are typically not part of this enterprise. Further, the letters of allocation from the government to the sector departments usually do not instruct the departments or the governmental agencies to spend money on interoperability actions. Actions for interoperability are therefore often seen as additional tasks which generate overhead and eat up possible surplus. Another barrier connected to finances is the placement of costs and benefits. Initiatives which obviously would be beneficial even at the national level are given low preference if the costs are placed in one department or agency, and if the immediate benefits appear in another.

2.2.4 National Joint Efforts

Chapter 2.1 provides examples of Norwegian best practice in organizational interoperability. According to the informants, one of the most important drivers toward broad organizational interoperability is the existence of large technology projects involving several influential organizations. Currently, too few such projects are active, thus constituting a hindrance for organizational (and other) interoperability. A majority of the informants mentioned Altinn (“AllIn”) as a school-book example of interoperability-enhancing projects, and they complained about the non-existence of similar efforts for the time being.

Such projects serve a number of purposes. They enhance knowledge of other organizations and their business processes (cf. Section 2.2.1), they offer a practical arena for integration and interoperability efforts, and they make progress because of the project organization as such. New hopes are directed towards newly initiated large-scale projects “eDialogue for public employers”, i.e. joint filing of salaries, personal taxes and payroll taxes, and “eID”, the establishment of electronic IDs and electronic signatures in the public sector (STM17, 2006). The hope is that these projects will become “new AllIns” with the same positive interoperability impacts organizationally and otherwise as the original one.

2.2.5 An Archipelago of Small Project Islands

In contrast to the large projects described above, the informants point to the myriad of small, uncoordinated projects and project initiatives as a major barrier to interoperability on all levels (both technical, semantic and organizational). The explanation to this is three-fold: First, many small ICT-development projects – often with universally relevant goals – are continuously being initiated without anchorage points in overall strategies for cross-sector development. Second, even if local projects could contain openings for interoperability, such projects seldom find a counterpart in other organizations, simply because the other organizations already have given priority to other projects. Third, scarce resources are used sub-optimally and cannot be fed into the financial portfolio of larger initiatives with ambitions of interoperability. Worst of all, perhaps, there is no catalogue or database which gives an overview of current and past projects small and large, for continuity and possible reuse of existing results.

2.2.6 Disharmony in Legislation

Legislation with all laws, provisions of Acts, rules and regulations is a huge complex with a broad range of impact areas. Consequently, new laws or amendments to an Act bring about uncertainties with respect to the total body of laws and the total area of impact; are there unintended consequences of the new law or amendment to other areas of jurisdiction, or does the new law, rule or regulation even prevent reasonable collaboration, such as provision of information from one public body to another? Or, which public body is legally responsible for services or information provided by a conglomerate of public bodies with distinct areas of legislation.

Indeed, our informants regard the legislative framework as an important area of practical obstacles to organizational interoperability. Double reporting of information to public registers is a frequent example of poor interoperability. Furthermore, one department may have no authority to request information from another department for case handling, or the law may directly prohibit merging information from different sources

for security or privacy reasons. Moreover, innovative electronic services may not be taken into use if the intention is to use information for other purposes than what the concession permits. Against this background of examples, it is reasonable to assert that disharmony in legislation hampers organizational interoperability.

2.2.7 Anaemic Arenas

Organizational interoperability requires collaborative arenas to succeed. There has to exist a common understanding of the importance of interoperability, strategies have to be worked out, mutual agreements have to be entered, etc. For organizational interoperability, such actions should be taken at the management level of participating organizations. For progress and continuity purposes there has to exist arenas where the top management meets regularly. According to the informants, some arenas do exist, but these have a tendency to turn into enervated meeting places. Vital arenas have an expiration date.

2.2.8 Invisible Best Practice

As mentioned earlier, organizational interoperability is difficult to define precisely (cf. Chapter 2.1), and it is non-trivial to implement. Complexities are connected to both formal agreements on collaboration and practical approaches to organizational interoperability. Our informants communicate unambiguously the need for good examples in general, and show-cases of best practice within particular domains, be it tools for process modelling, management of organizational alignment, or ICT-literacy. The fact that there is a shortage of best practice – or at least dissemination of this – constitutes an obstacle to the advancement of organizational interoperability.

2.2.9 People and their Leaders

When organizational interoperability is in focus, we have to take a look at the people who work in these organizations, and the management of people. The people-factor has individual and collective dimensions. According to the informants' experiences, many initiatives to practical collaboration (or organizational interoperability) fail because of negative attitudes and non-collaborative working practices. Put popularly, the following situations are more than common: There are people who simply do not like or want to work together with other people, or who are insecure or shy, and do not cope well in situations of interaction. There are leaders who do not promote collaboration, leaders who are afraid of losing existing positions if collaborations should lead to more rational distribution and organization of work, and authoritative leaders who simply do not ask anybody about anything. And there are trade unions that do not promote collaboration, also because of potential rationalization and loss of jobs. This hindrance to organizational interoperability is probably the most sensitive and the most difficult to counteract. One attempt that has been made in Norway is the recent publication of a leadership platform for leaders within the public sector (PLS, 2008). This poster states, among other things, that it is the responsibility of leaders within the public sector to collaborate with other organizations (Figure 3).

2.2.10 Ubiquitous Heterogeneity

In Norwegian, we have a proverb which says that "similar children play best". There is, in fact, a short way from this ordinary saying to multi-dimensional organizational constraints. Many of the informants express the view that a number of inherent differences hamper organizational interoperability. This starts with unequal levels of competency in general and digital literacy in particular, continues through differences in strategic thinking and foresight, organizational cultures, phases in development processes and available technologies, and ends in dissimilarities in available resources.

One illustration of this kind of obstacles to interoperability comes from the municipalities, counties and public enterprises under municipal or county ownership. In Norway, there are ca. 430 municipalities, varying from tiny rural communities to large urban centres. The scales of economy are totally different, and consequently the fiscal priorities vary from financing absolute necessities in poor municipalities, to fundamental renewal and innovation. The practical possibilities of different municipalities to participate for instance in the development of common ICT-solutions (and thus interoperability) are totally different. Moreover, the economy of the state is much stronger than that of individual municipalities. Another illustration of similar heterogeneity is the different modes of operation in governmental sector departments. Our informants assert that some departments promote (and finance) collaboration and interoperability initiatives in an excellent manner, while others – quite frankly – could not care less. So, there is a serious deficit of partnerships due to unequal preconditions.



Figure 3. The Norwegian principles^{vi} for good leadership states that each leader should collaborate with other organizations and be oriented towards change and new solutions

3. CONCLUSION

Barriers may be turned into opportunities by applying appropriate corrective measures. Eynon et al. (2007) propose four organizational, technical and legal key solutions to the barriers to eGovernment that they identified. These are: 1. Leadership failures: creating a network of eGovernment champions, 2. Digital divides and choices: segmentation, 3. Poor coordination: working with chaotic coordination 4. Workplace and organizational inflexibility: encouraging an 'eLiterate' workforce. Similarly, we propose actions that may be appropriate in order to counteract the ten barriers presented in Sections 2.2.1 – 2.2.10. With reference to the interview questions (cf. Chapter 2.1.), the informants were asked to make suggestions for appropriate measures to build down barriers to organizational interoperability. Below, in Table 1, some of these are presented as an illustration of possible approaches (i.e. no threshold for representativeness is applied here):

Table 1. Barriers to organizational interoperability and proposed cure

Barrier	Cure
Competency gaps	<ul style="list-style-type: none"> Establishment of interoperability forums for procurers and suppliers of ICTs. Competency measures within process modelling and uses of ICTs.
Missing "measurables"	<ul style="list-style-type: none"> Development of indicators and barometers for measuring organizational interoperability.
Money talks	<ul style="list-style-type: none"> Fiscal measures for dedicated funding of interoperability projects.
National joint efforts	<ul style="list-style-type: none"> Establishment of large ICT-projects with cross sector participation.
An archipelago of small project islands	<ul style="list-style-type: none"> Catalogue/database on previous and current ICT-projects. Appointment of coordinating project officer(s).
Disharmony in legislation	<ul style="list-style-type: none"> Consistency checks and profound consequence analyses. Development of ICT-tools for consistency check and consequence analyses.
Anaemic arenas	<ul style="list-style-type: none"> Replacement of over-mature meeting-places with top-level arenas for new initiatives.
Invisible best practice	<ul style="list-style-type: none"> Catalogue/database on best practice within formal contracts, project management, design of interoperable systems and services.
People and their leaders	<ul style="list-style-type: none"> Actions for organizational alignment (organization development projects). Recruitment of employees with complementary competency profiles.
Ubiquitous heterogeneity	<ul style="list-style-type: none"> Governmentally organized and financed innovation projects. Financial support for interoperability actions (governmental financing).

The Semicolon-project (see Acknowledgment) which the empirical work reported in this paper is part of, will continue related research in 2009-2010. One of the main activities within the work package of organizational interoperability is to go into detail on the identified barriers. This will be done by quantitative measurements of the barriers. An on-line survey will be designed for this purpose and carried out twice during the project.

Work in case organizations will also be done to promote appropriate measures for better organizational interoperability.

ACKNOWLEDGEMENT

This paper is a deliverable from the Semicolon-project (Semantic and Organizational Interoperability in Communicating and Collaborating Organisations). Semicolon is an R&D- project partly funded by the Norwegian Research Council. The main goal of Semicolon is to develop and test ICT-based methods, tools and metrics to obtain faster and cheaper semantic and organizational interoperability both with and within the public sector. One of the sub-goals is to identify obstacles for interoperability and strategy/solutions to tackle these. Four large and influential public bodies are engaged in Semicolon. These will provide real world collaboration example cases as study items for the project. The public bodies are the Brønnøysund Register Centre, the Directorate for Health and Social Affairs, Statistics Norway and The Norwegian Association of Local and Regional Authorities. Det Norske Veritas (DNV) is the coordinator and project owner.

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MAPPING E-GOVERNMENT STAKEHOLDER REQUIREMENTS TO PUBLIC ADMINISTRATION OPERATIONAL NEEDS

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ABSTRACT

This paper proposes a framework for e-government development projects aiming at the detection of inconsistencies, incompatibilities and mistakes during the early design stages. This is achieved by applying a Requirements Engineering methodology for the identification of stakeholder requirements and dependencies. Furthermore, a generic identification of public administration's functions is being proposed making it possible to detect deficits in service provision. Using a Goal Oriented Requirements Engineering methodology and relevant tools, stakeholders' and functional goals are mapped. An example of a knowledge management system, presenting the case of a Greek e-government application is discussed here in relation to the proposed framework.

KEYWORDS

e-Government, Public Administration, e-Government Stakeholder requirements, e-Government requirements

1. INTRODUCTION

Public Administration (PA) in general or Public Organizations (PO) more specifically should adjust to the new era of e-government. Yet, they are neither isolated nor independent. They belong to an administrative environment; they are accountable to political offices both at national and supranational level.

Government managers need to analyze and evaluate ICT choices because these choices are among the most complex and expensive decisions they are expected to make (Dawes et al., 2004). A PO needs to identify and satisfy all stakeholders with the implementation of an e-government initiative, because only then it is possible for such an initiative to succeed.

Information System (IS) projects begin by examining and understanding the business and organizational domain in which the information system is to be introduced. The system analysis phase of information systems development is concerned with representing this business domain (often called the "real world domain"). Such a description is termed a conceptual model: "Conceptual modelling is the activity of formally describing some aspects of the physical and social world around us for purposes of understanding and communication" (Mylopoulos, 1992)

The past fifteen years have seen the rise of a new phase in software development which is concerned with the acquisition, modelling and analysis of stakeholder purposes ("goals") in order to derive functional and non-functional requirements. (Mylopoulos, 2006)

This work aims at proposing a framework that addresses the need of introducing the right e-government system in an organization. It considers public organizations in EU member states and takes a country's administration (namely Greece) as a typical case. It identifies all stakeholders and by using formal sources, like policy and strategy papers, constitutions and principles in wielding and finally researches on citizens and businesses views, lists/registers their requirements. Stakeholders' requirements are non functional requirements and goals that every initiative has to achieve in order to be successful. Thus, it is essential for them to be analyzed and move from abstract to concrete, in order to be connected with organizational operations/procedures. To achieve this correspondence Goal Oriented Requirements Engineering (GORE) methodology and tools are used. Then a grid of intertwined goals is shaped.

The framework aims at providing a clear, unambiguous and shared understanding of the business or program objective an organization wants to achieve. Many projects go wrong at this very first step because those responsible assume everyone sees the situation and its resolution in the same way.

This paper is structured as follows: section 2 outlines the problem and reviews the related work. A comparison to the framework proposed, is also provided here. Section 3 presents the proposed solution. In section 4 a case study is presented and in section 5 a discussion about the proposals in this paper is held and potential results of the work are assessed.

2. RELATED WORK

Quite a few different methodologies and techniques used in mapping requirements are available. This section provides a brief presentation of the most popular amongst developers at the time of writing.

A) Object-oriented modelling languages such as UML have been developed for modelling software systems, not application domains. There is no formal account or analysis of the connection between the objectives of the different stakeholders (human, social or otherwise) and the system-to-be.

The main problem to overcome in using object-oriented IS design languages for conceptual modelling is the lack of meaning of language constructs such as 'object', 'class', 'attribute', and 'operation' when used to model application domains (Evermann & Wand, 2005)

B) The KAOS method (Knowledge Acquisition in auTOMated Specification) has been applied in industrial projects, in a wide variety of domains, to engineer requirements for fairly different types of systems (van Lamsweerde, 2001; 2005). The method has also been used to build goal oriented models for various strategic planning and business process reengineering projects, to reengineer unintelligible requirements documents, and to generate calls for tenders and tender evaluation forms in a large international organization. To the best of our knowledge there is no application of the KAOS method in the e-government domain.

C) Ontologies have long been used and accepted as a means to perform conceptual domain modelling in the knowledge engineering community (Swartout and Tate, 1999). Software-intensive systems require an essential way to build a common language that creates a shared understanding between stakeholders and promotes cohesiveness between the information gathered from diverse sources to guide their software engineering processes (Lee and Gandhi, 2005). To assist autonomous agent interactions, the use of ontologies resulting from the RE process has been suggested by Brietman et al. (2003). They outline a Language Extended Lexicon (LEL) (Leite & Franco, 1993) based approach to structured ontology construction. The LEL by itself does not carry any semantics unless it is instantiated using a conceptual model. Evermann and Wand (2005) discuss other ontology based object oriented domain modelling approaches in detail. These though are beyond the scope of this paper.

D) In TROPOS methodology the five main development phases are: Early Requirements, Late Requirements, Architectural Design, Detailed Design and Implementation (Castro et al., 2000). As an example of use of the TROPOS methodology in e-government projects is a real application developed for the local government of Trentino (Provincia Autonoma di Trento, or PAT). The e-Culture system is a web-based broker of cultural information and services for PAT, including information obtained from museums, exhibitions, and other cultural organizations and events (Bresciani et al., 2004).

Tropos adopts the *i** (Yu, 1995) modelling framework for analyzing requirements. The ultimate objective of requirement analysis in Tropos is to provide a set of functional and non-functional requirements for the system-to-be.

Forward and backward reasoning is supported in Tropos by the goal reasoning tool (GR-Tool). Basically, the GR-Tool is a graphical tool in which it is possible to draw the goal models and run the algorithms and tools for forward and backward reasoning (Giorgini et al., 2005).

The Tool for Agent Oriented visual Modelling for the Eclipse platform (TAOM4E) tool supports the TROPOS agent-oriented software engineering methodology. This tool is based on the Eclipse Platform that offers a flexible solution to the problem of component integration (Bertolini et al., 2006).

E) REF is a Requirements' Engineering Framework explicitly designed to support the analysts in reasoning about socio-technical systems, and transform high-level organizational needs into system requirements. By adopting concepts like Actors, Goals, and Intentional Dependency, and introducing an essential graphical notation, REF claims to be a very effective and usable tool. In addition, "REF supports the analysts in dealing with complex and system/organizational design related issues, such as shared and clashing stakeholders' needs, by introducing some specific analysis-oriented notations to allow an early marking and detection of such situations"(Donzelli and Bresciani, 2003)

While the proposed solution adopts the above mentioned theory and techniques of GORE, as well as the tools for visual representation of the framework it is differentiated by providing a holistic approach. That is:

- ◆ It considers / identifies stakeholders and their requirements in an upper, domain level (regardless of procedure) allowing depiction of all of them in an overall manner.
- ◆ It allows the consideration of PA as a whole. POs and units are instances of PA. Entrusting a public service to one of them might be occasional and the rationale that led to it might be revised.
- ◆ It studies PA's function in an abstract generic level classifying all operations in three levels. This will allow the use of the technique proposed here to all kinds of PA processes.
- ◆ It joins functional and non functional requirements assigning non functional stakeholder requirements to PA's operation.

3. PROPOSED SOLUTION

To facilitate decisions about introduction of systems that promote e-government and provide solutions to PA's operational needs, first we identify e-government stakeholders and their dependencies. Their goals are analyzed in the case study, by careful identification of all stakeholders and the ways they can influence or be affected by the project. Many projects limit stakeholder considerations to those who are directly involved in the development of a system. Generally, this is not enough, as those who are indirectly affected count too (Dawes et al., 2004).

Following the identification of goals an illustration of PA's operations is created. A simple but comprehensive/concise division of them is proposed along with an association of the categories resulted with essential needs of PA.

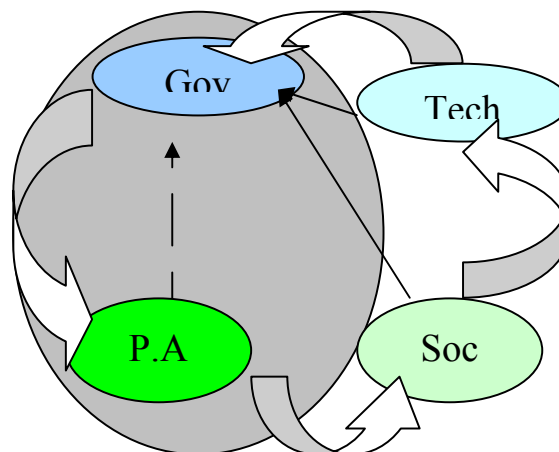


Figure 1. E-government life cycle

3.1 e Gov stakeholders' Dependencies

In Figure 1, stakeholders in an e-Government life cycle are considered. In the government frame both national and supranational authorities are included. Thus national government goals related to e-government or PA modernization and EU goals for a unified European aspect are identified.

In PA, goals of POs (PA entities) and goals of public servants coexist as entities of administrative universe of discourse too. Society supports goals from both citizens and businesses. Technology is considered as a stakeholder in the context of the use of state of the art technologies that would in turn pose specific requirements on human and financial resources.

Government transfers political-economical view, which results from inputs of society, PA and technology progress, as a need for good governance and starts the e government process, as a means to shift governance in order to adjust it to the current socioeconomic requirements. Additionally, this view depicts the current status of laws and institutions as frameworks in which any e-government initiative should evolve. Thus e-government is considered as a vehicle, which starts as a vision, concept and template from the government and follows the next steps in order to be implemented (block arrows). To these steps, needs and constraints are added.

Clockwise, technology oriented solutions have been tested, but they are not able to provide working results. For example for interoperability issues there is the option of the implementation of governmental intranets, but to exploit full dynamics of an interoperable linkage it is better to define involved administrative units and procedures. Additionally interoperability may be constrained by security issues. Similarly, simply following citizens' and businesses' wills is unwise. PA also defends constitutional principles and legitimacy that lie beyond these wills. Furthermore State serves citizens and businesses through PA and receives their messages for readjustment politics through various channels. Society cannot directly affect procedures that PA follows. This is the PA's managers' and executives' privilege. The final state is the new initial one and in proportion to the feedback, it might prompt for a new e-government initiative circle.

3.2 Stakeholders' Goals

This section presents an attempt by the authors to elicit stakeholder requirements using as sources formal documents and surveys. These were obtained from the official web sites of the EU and those of the fifteen older member states.

3.2.1 Current e-Government Strategies of EU 15 Older Member States

Having reviewed the vision and objectives for e-government in the EU's fifteen older member states through the study of strategy and policy documents, two dominant trends have been identified (Savvas et al., 2007):

- ◆ The first one focuses on the empowerment of democracy through an open, transparent and participatory society (social state model)
- ◆ The second aims at gathering economic returns through cuts on state expenditure or on the basis of raising competitiveness and of increasing jobs offered by businesses. Citizens obtain additional benefits through tax reduction. (Market driven model)

Components of the first one are: participation and transparency; and of the second one efficiency, effectiveness and money savings. The Greek government, like any other member state's government, belongs to this environment following good practices and being influenced by other members' strategies.

3.2.2 EU Goals/Requirements

For the EU, e-Government is expected to help public administrations to realise good governance ('e-governance') in terms of an administration that is:

- ◆ Open and transparent, i.e. democratic and accountable
- ◆ Inclusive, i.e. provides services for all
- ◆ Efficient and productive, i.e. provides maximum value for taxpayers' money.

These are goals identical to the ones mentioned previously for the governments of the EU's member states. The same, to an extent stands for the new i2010 e-Government Action Plan that defines five priorities (The new European strategy for Information Society i2010, 2005): 1) No citizen left behind, 2) Making

efficiency and effectiveness a reality, 3) Implementing high-impact key services for citizens and businesses, 4) Putting key enablers in place, 5) Strengthening participation and democratic decision-making.

In addition the European Union focuses in three groups of issues for e-Government beyond 2005 ("e-Government Beyond 2005", 2004): 1) more profound modernisation of public administrations for sustainable benefits, 2) innovation in government services and governance, 3) emergence of pan-European e-Government solutions.

EU goals follow behind national government ones because the EU's guidelines are not mandatory. But it is recommended to be taken into consideration from each member state government.

3.2.3 Citizen and Business Goals

Citizen and business requirements are reported in many studies held by various institutions throughout Europe. The majority of these studies are not focused on satisfaction of users but they simply assess people needs as a means for varied purposes. In this context recent studies (e-Government Unit, 2006), carried out by European Observatories for Information Society revealed/detected the goals presented below (Cap-Gemini, 2006).

Additionally, specific studies focusing on Greek citizens and businesses (Greek IS Observatory, 2006), (case study), and for Greeks and foreigners that live in Greece (EDET S.A., 2005), revealed their requirements as *Problem categories*: 60% of problems concern red tape and complicity of procedures and the long expectance for the processing of the requests of citizens and businesses. 38% concern vague legal framework that is the lack of an unvarying explanation and the complexity of the issue. 21% concern the shortage of forms which have to be fulfilled, the number of the copies needed, the administrative language used and the inconsistent demands. 6% of the complaints concern electronic (e-Government) services.

3.2.4 Other Goals

Public Organization - The main objective for POs in relation to the others is collaboration. This is divided in two parts: The ability and the will for collaboration. The ability refers to technical matters like system interoperability along with organizational and semantic issues. Will refers to people. For the case study our experience in Greek PA and practices and the interaction with managers and executives confirm the above need.

Public servants - Apart from financial requests public servants unions have repeatedly stated their goals for better working conditions along with a set of sub-goals. For the case study ADEDY was used as it is the bigger labour union of public servants in Greece. Its main goals were elicited from the various documents that it produces and distributes.

Technology goals - Technology requirements result both from technological evolution and evolution on project management and managerial choices, related to the use of applicable and sustainable systems. They also refer to cost evaluation and other economical matters. They are guided by scientific and technological progress (papers, projects, best practices etc.) Thus the overall environment of stakeholders' requirements in which an e-government initiative is taking place is formed as shown in figure 2 below.

In the overall environment contradictions may surface between different stakeholder requirements. For example Greece is a member state of the EU and in assessing the dominant role of each goal on an ad-hoc basis, it is essential to consider its European dimension as this might prevail over the local one.

Otherwise representation of interactions between stakeholders' goals is achieved through the use of e government life cycle. Sinisterly transition of goals and requirements ensures its infiltration.

4. AN e-GOVERNMENT SERVICE EXAMPLE

Due to the large number of legal norms that exist in Greece, there is a true need for help to civil servants who use legislation, in order to maintain an updated version. The development of a software system for the management of the preamble of administrative acts will allow the automatic retrieval and synthesis of the law in force and supportive material for the act's grounds for decision (Savvas, 2007).

The problem is two-fold. It concerns both the composition of an administrative act and its grounds for decision. It is based on the availability of an up to date legal framework and to the provision of the right knowledge to the right public servant, at the right moment, for the right case.

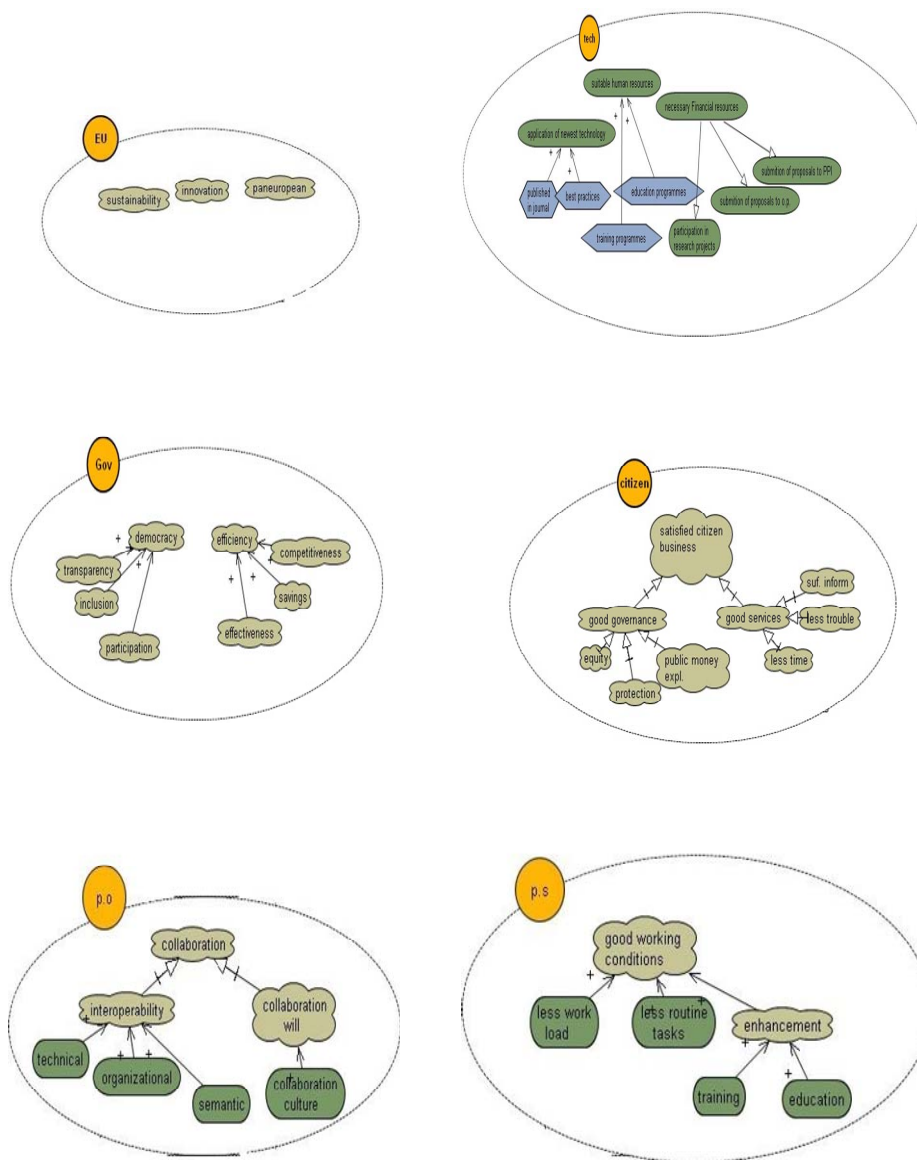


Figure 8. The overall framework with an elementary goal analysis

The operation of a system that would be in position to provide the proper legal framework for the production of an act, concerns both public servants who are responsible for that and citizens to whom the act is addressed to. It promotes and supports the principle of the “proper function of PA”. Finally the use of a knowledge base of precedents of acts, opinions and jurisprudence, adheres to the principles of “good administration”.

The system employs a Knowledge portal which contains the procedures that each administrative unit performs.

To design the templates, a knowledge engineer cooperates with experts (public servants) in order to acquire their knowledge. Knowledge is captured in ontologies. Building ontologies means entering in a process in which tacit knowledge is made conceptually explicit in a formal machine-readable language.

To provide these functionalities, an ontology of PA procedures has been built in OWL. This represents PA structure and documents. The procedures are represented in OWL-S service models.

To check the system according to the framework that proposed, the authors follow the principles of Requirements engineering as discussed by van Lamsweerde (2000):

A. the elicitation of the goals to be achieved by the system envisioned (WHY issues): legal updated template and case based reasoning

B. the operationalization of such goals into specifications of services and constraints (WHAT issues): support of public servants in composing acts, support of citizens in controlling PA (new service in the new era – the same procedure that will support PA service is used through telecommunication channels for citizens)

C. and the assignment of responsibilities for the resulting requirements to agents such as humans, devices and software available or to be developed (WHO issues): Administrative KM system, Ontology of PA procedures, RDF metadata, XML metadata, XML to RDF translator and other technologies concerning interface and nets.

The example presented above concerns construction of documents. Task copes with the document. In order to find additional requirements, for example, for the document, one can divide documents into informative ones and those supporting an act. An informative document has to fulfill requirements such as “less time”, “sufficient information” plus a set of principles of the administrative law, that specify “good governance” sub goals, like “justice” and “protection”.

Further analysis dealing with procedures namely with communication may lead to the following: communication must be facilitated between all entities of the administrative universe of discourse. This includes administrative units and citizens/businesses. To face the problem into the short term a multichannel approach is compulsory. Thus info kiosks, call centers, etc. should be established.

5. DISCUSSION - CONCLUSIONS

In this work a compatibility framework for a successful e-government initiative implementation is proposed. The framework is exposed to a National (e.g. Greek) PA environment. The effort focuses on thinking beyond technology; to thinking about systems in context. To draft the framework work has been split in two dimensions, the operational/functional needs of the PA and the stakeholders' goals.

The three main types of functions in PA were identified and their requirements in relation with the document, communication and information correspondingly roughly described. Additionally a first attempt of assigning non functional requirements (e.g. stakeholder goals) to functional areas of PA has being made. For example a whole procedure or service needs information for a certain goal. This goal might stand/be implanted to the external environment of the organization.

Following the correspondence between whole procedure (service) and information this could for example mean reengineering: New needs of a new social-economic environment (information that is not currently provided to any entity, must now be offered in the context of new stakeholders' requirements). Avoiding information redundancy [Information that already exist in databases and is not restricted due to personal data protection (citizen requirement) should not be submitted again.]

In conclusion, whenever an e-government initiative is to be undertaken, one should check whether both sides of this framework are satisfied; In other words, if operational needs and stakeholders' goals are fulfilled. It is proposed to keep the following process:

- ◆ Check if the system to-be responds to operational needs. If the system to-be concerns tasks, procedure or whole procedures and in what way.
- ◆ Check the system's goals in relation to stakeholders' requirements.
- ◆ Differentiate, if necessary, the parts that are not compatible to the former requirements.

To demonstrate the use of the proposed framework, a knowledge management system for the construction of documents in the case of the Greek PA has been used. The Greek PA's example was used since the goals of the stakeholders for that case had already been elicited. As operational needs of PA are fulfilled by an e-government system, they are its operational requirements. To these operational requirements stakeholder goals are mapped as implementation restrictions and guidelines.

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INNOVATION POLICIES -A REVIEW OF THE ROLE OF SERVICE IN TODAY'S IT ECONOMY

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ABSTRACT

In today's social and economic environment, three kinds of technologies (ICT, nanotechnology and biotechnology) are interrelated with each other in, so called, *transitional states*. As ICT industry has grown since the 1990s, nanotechnology and biotechnology are considered to be focal areas for intensive R&D. Meanwhile, the service industry is rapidly growing in most advanced countries. It is assumed that economic systems should be further utilized by clarifying value chain process embedded in the economy, and by enabling interactive innovations of the three transitional technologies in relation to service industry. To verify this assumption, multi-variable regression analysis is performed by using U.S. census data for fifty states to verify the correlation between GDP, service industry and the output in ICT, biotechnology, and nanotechnology at a regional level. As a result, it is clarified that there is a certain time period when the three technologies increase their interconnection with GDP and/or service industry, and that there is a possibility to determine the timing of implementing regional cluster policy according to the development phase of innovation. Lastly, this linkage should be further studied from the viewpoint of value chain so that the innovation system can be designed with further articulation for social and economic development and prosperity in today's service economy.

KEYWORDS

Innovation system, service industry, ICT, nanotechnology, biotechnology, regression analysis

1. INTRODUCTION

ICT investment is growing continually according to OECD ITO report as world ICT spending was up 5.0% a year over 2000-05 in current USD IT spending, and ICT market data and forecasts confirm expectations of moderately strong and widespread growth worldwide in 2006 (OECD, 2006a). In line with these trends, most major economies have been focused more on the momentum brought by innovation and R&D activities through ICT. Particularly, network-related service is an area in which the productivity is growing at the fastest pace. For example, in World Economic Forum 2008, Arun Sarin, Chief Executive Officer, Vodafone Group, United Kingdom, reported that the penetration rates of cell phone are 40% in China, 20% in India, 35% in Egypt and 70% in South Africa. In the same conference session, it is suggested that there is a possibility of using mobile media for telemedicine healthcare service in rural and developing areas¹.

Besides the socio-economic aspect of using technology, biotechnology² and nanotechnology³ have become a critical, integral part of these national policies in order to further enhance national competitiveness. Some of these technological fields are in a development phase and others are already commercialized and widely utilized in our daily life. For instance, drug delivery is being developed to meet the needs of aging

¹ World Economic Forum 2008, Saturday 26 Session URL (Retrieved Feb 8, 2008):

http://www.weforum.org/en/knowledge/KN_SESS_SUMM_23801?url=/en/knowledge/KN_SESS_SUMM_23801

² Biotechnology is defined as the application of science and technology to living organisms as well as parts, products and models thereof, to alter living or non-living materials for the production of knowledge, goods and services (Second OECD Ad Hoc Meeting on Biotechnology Statistics, 2001)

³ Nanotechnology is defined by National Nanotechnology Initiative as (1) research and technology development at the atomic, molecular or macromolecular levels, in approximately the 1–100 nm range; (2) creating and using structures, devices and systems that have novel properties and functions because of their small and/or intermediate size; and (3) the ability to control or manipulate on the atomic scale.

society and resulting organizational shifts in healthcare sector. Biosensors are produced as the integration of biological and electronic components. Green manufacturing is one possible solution for both ecological criticality and industry growth. Nano-biotechnology applications of protein engineering can be applied to a wide area of medical services and pharmaceuticals. Dr. Arden L. Bement, Jr., Director of U.S. National Science Foundation (NSF) suggested to a committee to the Senate that NSF focuses on the investment in IT-based initiative to support the discovery of knowledge '*at the intersection of the computational world and the physical and biological worlds*'⁴ (Bement Jr., 2007).

In the future, devices are becoming even smaller (from micro- to nano- scale). Individual components are more complicated where biotechnology, physics, and science should be utilized in one system or service. For such a transitional and interactive state in which social and economic activities are performed to achieve multi-dimensional values, I refer to this situation as 'three transitional states' of ICT, nanotechnology and biotechnology.

One approach to identify economic phases is 'the life cycle of a technology system' (Freeman & Louca, 2001). It takes six steps from the laboratory-invention phase with early applications in small scale through the growth phase with structural, political and regulatory changes to the maturity stage with the possibility of co-existence with new technologies or slow disappearance (ibid.). Following this definitions of technological phases, the 'transitional states' can be defined as 'the socio-economic situation where multiple technological areas are categorized in any of the above six phases, although not situated in the same industrial category, have interactions and significant influence for each other, and could be utilized in one system, component, or service.'

In this paper, the inter-relationship of the three technologies -ICT, nanotechnology and biotechnology- will be clarified from the viewpoint of innovation system based on theory review and statistical analyses. The preliminary assumption is that the collaboration and network of technologies in different fields must be strengthened to enhance innovative capabilities in both public and private sectors, which is to be achieved by employing various architectures, in particular, the distinctive characteristics of the growing service industry.

2. THREE TRANSITIONAL STATES AND TECHNOLOGICAL INNOVATION

Aghion and Howitt (1992) incorporate Schumpeterian view of creative destruction to describe how new inventions make older inventions obsolete. This R&D-based endogenous growth model predicts scale effects in which more resources, such as researchers or workers, devoted to R&D will generate a faster growth. Freeman & Soete (1997) also mentioned that innovation requires technological accumulation combined with technology imports, local activities, and proactive policies for infant industries. Meanwhile, Young (1998) sees scale effects as a factor to increase innovative activity and eventually improve output. Acemoglu (2002; 2003) explains that technical change can be understood as a response to profit incentives. Major characteristics of ICT-based economy are commonly known as scale effect on supply side assuming near zero marginal cost and on demand side of network externalities. These characteristics have caused us to create new business models and services with additional values (Shapiro, Varian, and Farrel, 2004). The values and creativity distributed over the network is a key to understand the interactive effect of the transitional states in terms of economic success.

Cumulative knowledge and efforts to establish cross-institutional channels for collaborative work should be supported in organization, region and country for nanotechnology (Zucker, Darby, Furner, Liu, & Hongyan, 2007). Bozeman et al (quoting Rothaermel and Thursby, 2007) argued that large biotechnology corporations have relatively not been displaced due to startup firms where innovations are taking place. This is also true to nanotechnology firms according to Shea (2005), which must make large investment into manufacturing equipment and R&D to achieve successful commercialization. The clarification of linkage between innovation and commercialization within the network is an essential element in the economy.

'Multi-technology' capability and patent portfolio play a role in the success of operation. One of the examples that show the interactive effect of the three transitional technologies, the invention of microchip

⁴ This initiative is called 'Cyber-enabled Discovery and Innovation (CDI)' in which NSF will allocate \$52 million from 2008. For fundamental research in nanotechnology, NSF will invest approximately \$390 million. (Bement Jr., 2007)

and the development from discrete to integrated circuits supported large corporations to achieve cost reduction and performance improvement or other industries. As a result, telecommunication, computer, and electronics combined has contributed to a huge economic success in which 'the high degree of uncertainty and huge investment costs in microelectronics' created an entry barrier and made itself R&D intensive. As with the dimension of computer and software industry, it has impacted most service industries with an increase in labor productivity.

The analyses that have been performed by OECD verify the linkage with service industry in terms of knowledge intensiveness. They have discovered that the growth through innovation requires knowledge intensive service activities such as R&D, ICT services, and HR management. Especially, service sectors play a role to create a linkage between organizations, value chains, and industrial clusters and to provide knowledge and resources (OECD, 2006b). The development of transitional technologies has caused the interconnection of social and economic structure to get deepened where service plays a role to create a link among various industries and technologies.

Furthermore, as Powell, Bow & Koput (2002), Porter (2004), Council on Competitiveness (2007) and OECD (2007a) commonly emphasize the role of regional clustering to play in today's global economy. Regional elements have come to play a key role in innovation activities. As knowledge-intensive activities increase, they are more geographically agglomerated and clustered even with the intensive implementation of information technology. The Council of Competitiveness articulates the importance of regional innovation systems to be focused on innovation achieved with regional asset, culture, and network (*ibid.*).

In U.S., for example, there are several regions where biotechnology is rapidly growing i.e. California, Massachusetts and New Jersey based on state data (U.S. Department of Commerce, 2006 and U.S. Census Bureau). It can be assumed that common elements for economic success in biotechnology are high ratio of doctoral scientists and engineer to total workforce, and active entrepreneurship. The strong partnership between industry and university is another common, critical element.

The interconnection and interaction in the transitional states is being taken shape in our economy and society in various forms based on such economic development models, market structure, characteristics of each technology and service industry, and global and regional environment. For example, wireless communication and nano-scale sensors are combined so that ubiquitous environment is created for i.e. monitoring power level at manufacturing facilities and in residential houses, and providing remote diagnostics and preventive healthcare services. Environment and energy-related technology has also potential to provide new solutions for nuclear waste management by creating intelligent systems. It would secure stable and safe energy sources.

Furthermore, new genome sequencing for new diagnostics and therapeutics, remote and in-vivo devices, and drug delivery are a joint area of the three technologies. Drug Delivery System (DDS) is gathering attention because this technology enables new therapeutics for cancer treatment and life-style diseases (high cholesterol and diabetes). These new services need such technology as Micro Electro Mechanical Systems (MEMS) and nano-scale measurement techniques. When DDS is implemented in hospitals and care facilities, cancer diagnostics and treatment will be dramatically altered. Cancer treatment is known as requiring high medical costs for patients for long term intensive care. By reducing the period and amount of treatment, patients will receive medical care of higher quality for a shorter term. These changes may affect how hospital care and preventive health care should be provided in our community. It would resolve or mitigate negative effects being posed on our life and economy by high medical cost and dysfunctional social welfare system.

According to the literature review, it is suggested that the collaborative linkage of the three technologies should be clarified in terms of the relationship with service industry and gross output from the viewpoint of geographical proximity. It can achieve better intra- and inter-institutional sharing of knowledge and innovation in a cluster model. It may successfully lead to commercialization phase. A long-term perspective is also necessary to promote interaction between various technologies and promote reorganization of existing industrial boundaries. To achieve this, appropriate policy programs are necessary with a focus on service industry to help overall economy to grow.

3. MODEL

Under such circumstances, research is performed so that the relationship of the three technologies and the scope of service-enabled economic infrastructure are clarified. The analysis is focused on regional data to draw policy implications for socio-economic infrastructure and S&T packages. To verify the above-mentioned relationship, the following hypotheses are presented:

Hypothesis A: There is a positive correlation between GDP and the three transitional states (nanotechnology, biotechnology and information technology) at regional level.

Hypothesis B: In areas where GDP from nanotechnology is relatively high compared to the other areas, the total GDP from biotechnology and information technology may also be higher, and vice versa.

Hypothesis C: In areas where the interconnection between nanotechnology, biotechnology, and information is strong, the output in service industry may be large compared to the other areas.

Since biotechnology is mostly dominated by U.S. corporations in terms of revenues and R&D expenditures (app. 80% according to Ernst & Young, 2006; 2007). There is certain data showing clear state-level differences of performance in U.S. market (Battle Technology Partnership Practice and SSTI, 2006). Therefore, it is reasonable to use U.S. state data for analysis. The following data sets are prepared⁵: (i) real GDP by state (USD), (ii) output by state in ICT, nanotechnology, biotechnology and service industry (USD), and (iii) labor in ICT, nanotechnology and biotechnology in 1997 and 2002 (number of employees). Data is categorized according to North American Industry Classification System (NAICS) 2002⁶, and collected for fifty states. As for data notation, refer to Table 1 for detail.

Liner multi-variable regression⁷ is performed, and the following equations are analyzed for 1997 and 2002 data. The equation (1) and (3) through (6) are mainly investigating the correlation between GDP or output in service industry on flow basis. The equation (2) and (7) are examining on stock (labor) basis. Please refer to Table 2 and 3 for result in detail.

Hypothesis A:

$$Gdp_{0,i} = \beta_0 + \beta_1 Bio_{0,i} + \beta_2 Inf_{0,i} + \beta_3 Nan_{0,i} + u \dots\dots\dots (1)$$

$$Gdp_{0,i} = \beta_0 + \beta_1 LBio_{0,i} + \beta_2 LInf_{0,i} + \beta_3 LNan_{0,i} + u \dots\dots\dots (2)$$

Hypothesis B:

$$Nan_{0,i} = \beta_0 + \beta_1 Bio_{0,i} + \beta_2 Inf_{0,i} + u \dots\dots\dots (3)$$

$$Bio_{1,i} = \beta_0 + \beta_1 Inf_{1,i} + \beta_2 Nan_{1,i} + u \dots\dots\dots (4)$$

$$Inf_{0,i} = \beta_0 + \beta_1 Nan_{0,i} + \beta_2 Bio_{0,i} + u \dots\dots\dots (5)$$

Hypothesis C:

$$Ser_{0,i} = \beta_0 + \beta_1 Bio_{0,i} + \beta_2 Inf_{0,i} + \beta_3 Nan_{0,i} + u \dots\dots\dots (6)$$

$$Ser_{0,i} = \beta_0 + \beta_1 LBio_{0,i} + \beta_2 LInf_{0,i} + \beta_3 LNan_{0,i} + u \dots\dots\dots (7)$$

⁵ Source: the Bureau of Economic Analysis, U.S. Department of Commerce; Economy-Wide Key Statistics in 2002 and 1997, Economic Census, U.S. Census Bureau; Bureau of Labor Statistics, U.S. Department of Labor

⁶ 2002 NAICS code.

Biotechnology: 311211, 311222, 311223, 325193, 325199, 325221, 325311, 325312, 325314, 325320, 325411, 325412, 325413, 325414, 334517, 339111, 339112, 339113, 339114, 339115, 339116, 541710, 621511, 621512, 334510.

Nanotechnology: 21, 32518, 32541, 32561, 325211, 327999, 331, 332117, 333295, 333314, 333913, 33411, 334413, 334419, 334515, 334516, 334519, 335314, 335991, 3364, 541380.

Information: 511, 512, 515, 517, 518. Service: 518, 519, 532, 541, 561, 562, 611, 621, 722, 812, 3333, 4853.

The categorical definition for nanotechnology and biotechnology varies by reference.

⁷ In a linear regression, data is excluded sample-wise from computation if it exceeds 3 sd. Variance Inflation Factor (VIF) should be less than 10 to see if a variable is acceptable from collinearity point of view. For each procedure, backward method is employed to determine the most influential independent variable. Any variable is removed from a model if the probability of F is more than 0.1.

Table 1. Data Description and Notation

Data Description	Notation
Information	
Gross domestic product (USD, thou) by state in 1997 and 2002	Inf ₀ , Inf ₁
Employees (no.) by state in 1997 and 2002	LInf ₀ , LInf ₁
Nanotechnology	
Gross domestic product (USD, thou) by state in 1997 and 2002	Nan ₀ , Nan ₁
Employees (no.) by state in 1997 and 2002	LNan ₀ , LNaN ₁
Biotechnology	
Gross domestic product (USD, thou) by state in 1997 and 2002	Bio ₀ , Bio ₁
Employees (no.) by state in 1997 and 2002	LBio ₀ , LBio ₁
GDP	
Gross domestic product (USD, thou) by state in 1997 and 2002	Gdp ₀ , Gdp ₁
Service	
Gross domestic product (USD, thou) by state in 1997 and 2002	Ser ₀ , Ser ₁

*₀: 1997, ₁: 2002

4. ANALYSIS

According to the multi-variable regression analysis, the output of information sector has been the most influential variable in terms of the relationship with GDP both in 1997 and 2002 (See Table 2). This result should be due to the fact that ICT has achieved stable productivity growth and shifted more toward service industry. Nanotechnology and biotechnology are reciprocal. As for the relationship with nanotechnology and ICT, no correlation is observed in either 1997 or 2002.

Biotechnology has appeared relatively late in the economy. Therefore, one policy implication is that geographical concentration of research institutions, firms and market for biotechnology and information should still be encouraged. It can promote the growth of information, service industry and GDP at the state level. In this stage, the improvement of productivity must be most emphasized. In general, when its productivity has already grown enough and inter-regional supply chain has been established, if a given technological sector is not subject to regional elements in terms of output. It depends on the degree of maturity and saturation in the economy.

For example, University of California historically has more patents than Amgen or Genentech⁸ (BayBio, 2007) with federal financial supports for basic research. However, the amount of fund necessary for the commercialization of drugs has been increasing (ibid.). It makes it difficult for ventures or small laboratories to survive in global competition. Thus, large biotechnology corporations must play a role in generating demands and undertaking marketing activities. Venture capitals must also be supported for financial stability. Therefore, it is essential to link innovations to the market by utilizing ICT, and to achieve high productivity and improve efficiency for not only large corporations but also venture capitals and start-ups. In this sense, regional concentration of resources and institutions for biotechnology can be encouraged by policy programs with a focus on its connection with ICT and service industry.

Meanwhile, nanotechnology has shown a stronger correlation with GDP in terms of the number of employees by state. This is due to the rapid growth of labor productivity. The productivity of semiconductor, related device mfg and other electronic component mfg, for example, has grown by 260% from 1997 to 2002 (Productivity data from U.S. Bureau of Labor Statistics). On the other hand, some biotechnology sectors i.e. medicinal and botanical mfg, pharmaceutical preparation mfg, in-vitro diagnostic substance mfg, and biological product (except diagnostic) mfg, which compose a substantial part of biotechnology sector, generally exhibit a lower labor productivity of 97% in 2002 than the base year of 1997 (ibid.). These differences in labor productivity seem to cause the different result in stock (labor) from the analysis of flow (GDP).

It is important to clarify which areas the technology can be applied and commercialized, and how the technology interconnects with biotechnology and ICT to change current industry boundaries. The

⁸ AMGen and Genentech are top biotechnology companies in the world in terms of sales and revenues.

commercialization and applications of nanotechnology vary across time horizon. ROI and market potential of some fields are still unseen. Therefore, it is more appropriate to discuss nanotechnology from a long term perspectives. Innovations in nanotechnology facilitate the development of information industry and the growth of biotechnology from the viewpoint of productivity, but not necessarily from the viewpoint of regional output. The geographical element may not be so important as in biotechnology even though there are some signs and data that show benefits of geographical concentration of nanotechnology industry in the knowledge creation phase (Zucker, Darby, Furner, Liu, & Hongyan, 2007). Therefore, study at national and international level may be more useful to capture the overall trend in the transitional states.

As for service industry, information industry in 1997 and 2002 is statistically significant at the 1% level. Nanotechnology is at the 5% level in 1997 only, and biotechnology is significant at the 1% level in 2002 only. This means that the information industry has remained strong in terms of the correlation with the service industry while biotechnology has becoming a new player which positively affects the service industry.

Table 2. Regression Analysis

Equation	Model Description			Correlation			ANNOVA	
	Model	Dependent Var	Predictors	Adjusted R ²	Partial	Sig. (0.01**, 0.05*)	F	Sig.
(1)	1	Gdp0	Nan0, Inf0, Bio0	.97	-0.00, 0.48, 0.10	0.78, 0.00**, 0.00**	297.33	0.00
	2	Gdp0	Inf0, Bio0	.97	0.91, 0.59	0.00**, 0.00**	454.91	0.00
(1')	1	Gdp1	Nan1, Inf1, Bio1	.98	0.06, 0.80, 0.58	0.68, 0.00**, 0.00**	396.84	0.00
	2	Gdp1	Inf1, Bio1	.98	0.81, 0.73	0.00**, 0.00**	605.90	0.00
(2)	1	Gdp0	LNan0, LInf0, LBio0	.98	-0.01, 0.66, 0.23	0.92, 0.00**, 0.10	416.48	0.00
	2	Gdp0	LInf0, LBio0	.98	0.67, 0.28	0.00**, 0.05*	638.16	0.00
(2')	1	Gdp1	LNan1, LInf1, LBio1	.97	0.51, 0.74, 0.08	0.00**, 0.00**, 0.57	311.27	0.00
	2	Gdp1	LNan1, LInf1	.97	0.54, 0.88	0.00**, 0.00**	473.63	0.00
(3)	1	Nan0	Inf0, Bio0	.91	0.22, 0.78	0.11, 0.00**	120.43	0.00
	2	Nan0	Bio0	.91	0.90	0.00**	230.92	0.00
(3')	1	Nan1	Inf1, Bio1	.84	-0.27, 0.71	0.05*, 0.00**	60.85	0.00
(4)	1	Bio0	Nan0, Inf0	.91	0.78, 0.28	0.00**, 0.04*	124.89	0.00
(4')	1	Bio1	Nan1, Inf1	.94	0.71, 0.79	0.00**, 0.00**	185.58	0.00
(5)	1	Inf0	Nan0, Bio0	.79	0.22, 0.28	0.11, 0.04*	36.23	0.00
	2	Inf0	Bio0	.76	0.76	0.00**	67.74	0.00
(5')	1	Inf1	Nan1, Bio1	.89	-0.27, 0.79	0.05*, 0.00**	88.72	0.00
(6)	1	Ser0	Nan0, Inf0, Bio0	.97	0.25, 0.93, -0.03	0.08, 0.00**, 0.76	304.72	0.00
	2	Ser0	Nan0, Inf0	.97	0.34, 0.97	0.02*, 0.00**	466.51	0.00
	1	Ser1	Nan1, Inf1, Bio1	.98	-0.22, 0.84, 0.62	0.12, 0.00**, 0.00**	428.01	0.00
	2	Ser1	Inf1, Bio1	.98	0.85, 0.66	0.00**, 0.00**	621.48	0.00
(7)	1	Ser0	LNan0, LInf0, LBio0	.98	0.03, 0.80, 0.09	0.82, 0.0015:5715:57, 0.51	677.92	0.00
	2	Ser0	LInf0, LBio0	.98	0.81, 0.14	0.00**, 0.32	1038.27	0.00
	3	Ser0	LInf0	.98	0.98	0.00**	2075.84	0.00
	1	Ser1	LNan1, LInf1, LBio1	.97	0.33, 0.76, 0.20	0.02*, 0.00**, 0.16	324.72	0.00
(7')	2	Ser1	LNan1, LInf1	.97	0.38, 0.90	0.00**, 0.00**	475.74	0.00

5. CONCLUSION

This paper examines enhanced innovation capabilities in the collaboration of technologies. The interconnection and network of these three transitional states could reach its full potential by using various supporting service architectures. Investigation of data, literature review and statistical analyses are performed to present a model of interactions and collaboration in comprehensive, multi-technological innovation system (See Figure 1).

In today's society and economy, there is a strong need to strengthen innovative capabilities encompassing public and private sectors. Not limited to linear innovation model, new perspectives are required to promote interactive innovation system. To do this, macro- and micro- economic data should be collected and analyzed to design and implement an innovation system for each development phase. Such efforts also help us to clarify how ICT economy will evolve in the next generation. This paper concludes that there is a requirement for establishing 'compound' analysis of various fields of technology. This should be done to capture comprehensive and complex outcomes that the three transitional technologies would bring into the society and economy.

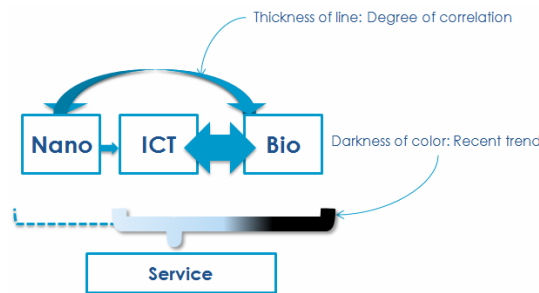


Figure 1. Correlation of Three Technologies and Service Industry

ACKNOWLEDGEMENT

Special gratitude for Prof. Osamu Sudoh and Associate Prof. Hideyuki Tanaka at the University of Tokyo for their support and advice.

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USERS' ATTITUDES TOWARDS ANONYMITY IN USER GENERATED CONTENT: BASED ON STRUCTURE OF ANONYMITY

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ABSTRACT

UGC (User Generated Content) is currently popular for exchanging information amongst Internet users. Although users in Japan make good use of such UGC, they prefer to remain anonymous. This paper aims to evaluate the usage of UGC and users' attitudes towards anonymity on the Internet. First we classify anonymity according to three different viewpoints: the traceability, linkability and identity treatment layers. Then we discuss the development of various research questions. Finally, we report on the results of an online survey and the factor and cluster analyses thereof. The results confirm that UGC appears to be useful. Traceability and linkability are distinguishable in attitude, but this is not reflected in behavior.

KEYWORDS

Anonymity, User Generated Content, Privacy

1. INTRODUCTION

A strange phenomenon exists in Japan, where 88 million people use the Internet. Most users participate in online communities thus contributing to the UGC (User Generated Content), but they tend to remain anonymous. As for blogs, according to Technorati's report (2007), the most prolific blogs are written by Japanese (37%). However, according to another report by japan.internet.com (2006), only 6.6% of bloggers in Japan display their real names. As for Social Networking Services (SNS), according to the survey by Comscore (2008), mixi, the largest SNS in Japan, earns 12,738,000 unique visitors per month, whereas Facebook, one of the largest SNSs in the world, earns only 538 thousand per month in Japan. Facebook displays a user's real name, whereas mixi provides the option to hide it.

70% of Internet users in Japan are members of at least one online community, but 60.9% of them hide their real names (Internet Association Japan, 2007). Although they communicate anonymously, Internet users often refer to UGC before making purchases. According to the survey by MyVoice.com (2007), UGC is the most widely used information source (52.4%) consulted before making purchases, ahead of TV-CM (47.6%). How is it possible to make the best use of online communities anonymously? How do users enjoy online communities anonymously? As Walther (1995) mentioned, electronic communication can promote relational communication, but if most participants remain anonymous, how can we grow the relationship over time?

The purpose of this paper is to explore users' attitudes towards anonymity and linkability in UGC, based on our classification of the anonymity structure. Most survey reports do not distinguish between anonymity and pseudonymity; we consider "no name" and "nickname" to be different.

In the next section we classify anonymity according to previous research. Then we describe the design of our research in Section 3. Section 4 gives the results of ranking, ratio, factor analysis and cluster analysis. A discussion and conclusions follow in Section 5.

2. ANONYMITY ON THE INTERNET

2.1 Effects of Anonymity in Online Communication

Although anonymity on the Internet has been studied in various fields, the classification of anonymity is fragmented. In the Computer-Mediated Communication (CMC) field, anonymity stands for “visual anonymity”, as apposed to face-to-face communication. Moreover, a continuously used handle (online-nickname) and one-time handle are not distinguished (Joinson, 2003). As defined by “Anonymous” author, anonymity is the “degree to which a communicator perceives the message source as unknown or unspecified” (Anonymous, 1998). One major classification of anonymity is the following; fully anonymous, partially anonymous “pseudonym”, and fully identified.

Anonymity causes a reduction in social cues. This provides both advantages and disadvantages to online communication. It provides self disclosure in the social support context, but also causes uncontrolled “flaming”, hostile and insulting interaction amongst users. It brings about equality in communication without prejudice, but this also means a lack of background information. Several experiments and research have shown that anonymous communication brings both self-disclosure and disinhibition compared with face-to-face or identified communication (Connolly et al., 1990) (Bargh et al., 2004). Thus Internet users have tried to use the anonymous state correctly (Otani, 2008).

2.2 Structure of Anonymity

To classify anonymity from a structural viewpoint, we focus on “(un)linkability” from the terminology definitions seasonally renewed since 2000 by Pfizmann and Hansen (2008), together with the treatment of (un)linkability proposed by Kobsa (2003). The elements of anonymity are explained in the following three subsections.

2.2.1 Traceability and Untraceability

The existence of a person can be traced using basic information (Name, Address, Birthday and Sex), payment information (Account No. and Credit card No.) and so on. If a person is untraceable, s/he is anonymous. Name is the key factor in traceability. Thus most people just hide their real names to remain anonymous on the Internet.

2.2.2 Linkability and Unlinkability

In “anon terminology” three anonymity elements are described; unobservability, unlinkability and pseudonymity (Pfizmann and Hansen, 2008). Although their paper was written from an attacker’s point of view, the basic idea can be applied to online communication. In this context, IOIs (items of interest) can be interpreted as messages, actions and so on, while attackers can be interpreted as observers.

Thus the linkability of two or more IOIs means that the observer can clearly distinguish whether these IOIs are related or not. Unlinkability of IOIs, or the negation of linkability, means the observer cannot clearly distinguish whether the IOIs are related or not. In other words, if messages posted to an online community are unlinkable, we are not able to reconstruct the personality of the respective participants. On the contrary, if messages are linkable, we can inductively add pseudonyms to the entities posting the messages. Thus unlinkability ensures greater anonymity (Fig. 1).

Figure 2 represents the relationship between traceability and linkability. The lower half of the figure contains two categories of “untraceable”, generally referred to simply as “anonymous”, but we distinguish the two quadrants. The quadrant defined as untraceable but linkable represents the “pseudonymous” state, which provides lesser anonymity, while the quadrant defined as untraceable and unlinkable is adopted as the “anonymous” state, which provides higher anonymity.

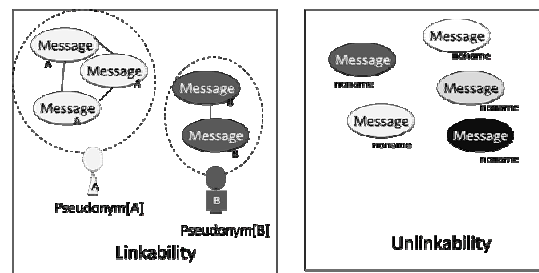


Figure 1. Linkability and Unlinkability

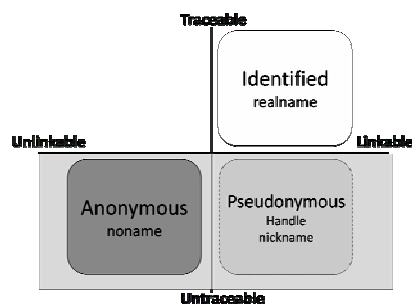


Figure 2. Classification of the Anonymous state

2.2.3 Identity treatment layers

Identity, including anonymity, should be dealt with at different levels (Kobsa, 2004). Thus for an online community, the treatment of identity is divided into three layers (Table 1). With this classification, it is possible to realize an anonymous, yet accountable online community (Orita, 2006). For example, the “Service Registered Layer” ensures linkability, while the “User Interaction Layer” provides unlinkability. This paper focuses mainly on the User’s Interaction Layer.

Table 1. Identity Treatment Layers

Layers	Examples
User's Interaction Layer	name, handle, no name
Service Registered Layer	registration to community
Personal Information Layer	IP address, payment information.

3. RESEARCH DESIGN

This research study uses quantitative research methods. To explore the tendency of active Internet users in Japan, we adopt one of the largest online research panels that gathers members via UGC and affiliates, instead of undertaking a random sampling survey. The research sample includes 518 individuals, divided into six cells; Male or Female, and Light, Middle or Heavy Internet users (Table 2). Having a service-ID means that the user’s activities (e.g. postings, access log, rating and so on) are linkable in at least the service layer, as described in Section 2. We chose communities with at least 35% of the users in the survey.

Research questions were developed for two purposes. RQ1 and RQ2 were designed to explore the usage of online communities:

RQ1: How do they use UGC platforms?

RQ2: Are they satisfied with UGC?

Secondly, to explore users’ attitudes towards anonymity, RQ3 and RQ4 were created.

RQ3: What kind of information do they want to display or hide in online communities?

RQ4: Are they aware of linkability?

Table 2. Research Overview

Samples	Macromill survey panel Age 20-59; Male 50%, Female 50% At least one UGC-ID holder Light users 33%, Middle users 33%, Heavy users 34%
Valid answers	518 (Screened from 10,000)
Cells (Equalized)	Male-A, Female-A: under 1 hour/day Male-B, Female-B: 1-5 hours/day Male-C, Female-C: above 5 hours/day
Means	Web-based questionnaire
Period	6 th and 7 th September 2008

4. RESULTS

4.1 UGC Usage

4.1.1 RAM and ROM: Activity in UGC

34.9% of users have experience in consulting (not only reading, but also posting messages) with others via UGC, while 93.6% have experience in collecting information (read only). In most communities, the number of Read-Only Members (ROM) is significantly higher than Radical-Access Members (RAM). BBS of SNS only shows equal ratio of RAM and ROM.

4.1.2 Satisfaction

Figure 3 shows satisfaction per topic discussed on UGC platforms. Around 20% of users have participated in discussing “PC, home electronics”, “hobby” and “health, illness” topics. They seem to share information about not only searching goods but also experience goods. Overall a high satisfaction trend is evident.

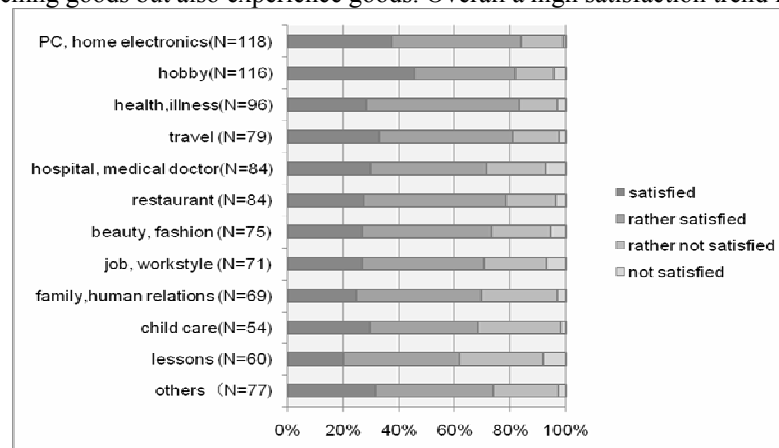


Figure 3. Satisfaction by topic

4.2 Attitude to and Awareness of Linkability

4.2.1 Factor Analysis

Based on the results of factor analysis, two factors are presented in Table3.

Factor1 corresponds to *Personal Information*, while *Factor2* corresponds to *Linkability*.

Table 3. Factor scores for rotated factor solution

	factor		commonalities
	1	2	
display/hide Profile	0.87	0.49	0.28
display/hide Attribute	0.85	0.47	0.35
display/hide History	0.65	0.61	0.79
open to / secret from Friends	0.56	0.49	0.56
display/hide Real name	0.53	0.32	0.76
same/different handle	0.44	0.89	0.72
registered handle/ noname	0.47	0.75	0.50
portable/ different handle	0.50	0.58	0.37
proportion	3.16	2.85	

With respect to *Personal Information* related to traceability, the results show a tendency to hide personal information, especially the “real name”. On the contrary, regarding the *Linkability* factor, there is a tendency to be “linkable” rather than “unlinkable”.

4.2.2 Cluster Analysis

For the cluster analysis using the Ward method, samples are divided into the following three clusters:

Cluster 1 (N=126, 24.3%): Prefer to be “identified”, traceable, and linkable

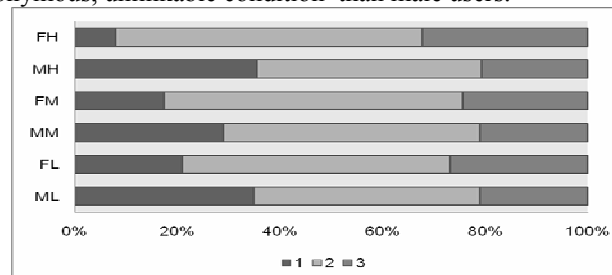
Cluster 2 (N=266, 51.3%): Prefer to be “pseudonymous”, untraceable, but linkable

Cluster 3 (N=126, 24.3%): Prefer to be “anonymous”, untraceable, and unlinkable

(1) Six cells (sex and usage)

Results of the cross-tabulation across six cells show the difference in internet usage time between male and female users and, together with the statistical significance thereof (Fig. 5).

Cluster 1 [identified] contains about 40% of the Male-Heavy (MH) and Male-Light (ML) cells, but only 8.1% of the Female-Heavy (FH) cells. *Cluster 2 [pseudonymous]* contains more than half of the Female users irrespective of usage. *Cluster 3 [anonymous]* contains 30% of Female-Heavy users. Female users show a higher tendency to remain anonymous, unlinkable condition than male users.



Chi-Square Tests			
	Value	df	Asymp.Sig. (2-sided)
Pearson Chi-square	28.45	10	0.00
Likelihood ratio	30.78	10	0.00
Linear-by-Linear Association	16.72	1	0.00
No. of valid cases	518		

Figure 5. Cross tabulation across six cells (N=518)

(2) Structure of UGC platform

Results of the cross tabulation regarding attitude towards different settings of UGC platform are given in Figs. 6 and 7 together with the statistical significance thereof. We focus on two settings to highlight the difference in attitude.

Setting 1: Handle (History is hidden)

[A] Use a handle with registration, posting history is hidden

[B] Use several handles without registration, posting history is hidden

Both *Cluster 1 [identified]* and *Cluster 2 [pseudonymous]* prefer a registered handle, while over 50% of *Cluster 3 [anonymous]* prefer an unlinkable setting (Fig. 6).

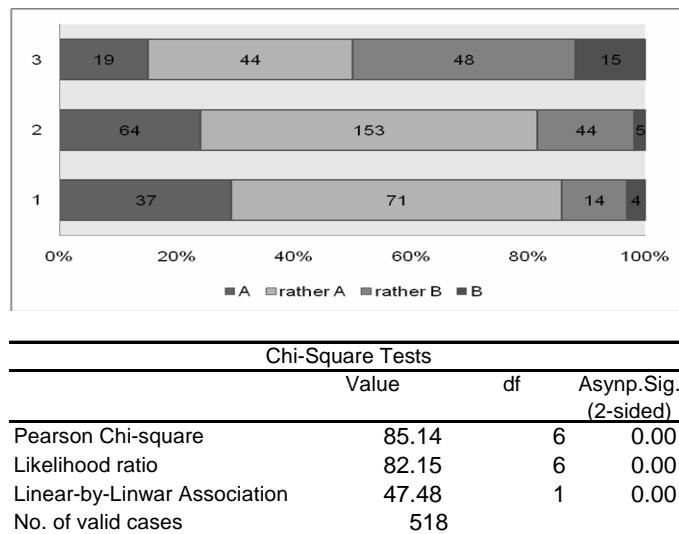


Figure 6. Cross tabulation with different UGC settings: setting 1 (N=518)

Setting 2: History (Handle is registered)

[A] Use a handle with registration, posting history is displayed

[B] Use a handle with registration, posting history is hidden

80% of *Cluster 1 [identified]* prefer to display posting history. *Cluster 2 [pseudonymous]* shows a similar tendency, but approximately 30% of users prefer to hide the history. *Cluster 3 [anonymous]* shows the opposite tendency; 63% prefer not to display linkable history (Fig. 7).

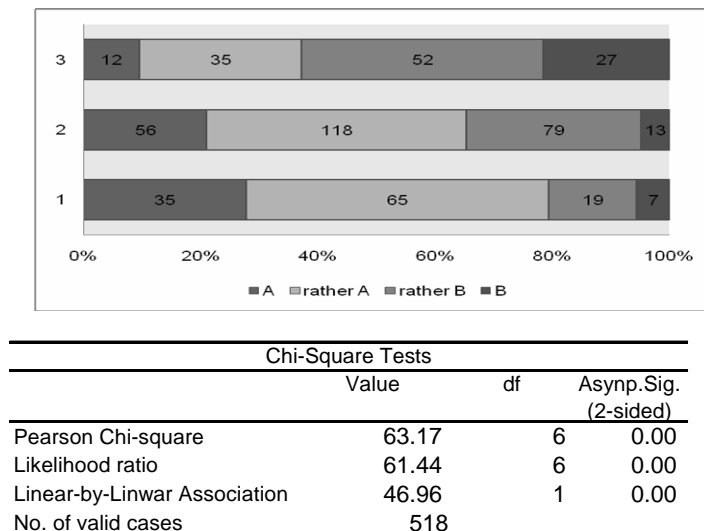


Figure 7. Cross tabulation with different UGC settings: setting 2 (N=518)

(3) Usage of UGC platform

The results of the cross-tabulation for usage of different category of UGC platforms (Table 3), show no statistical significance. Thus the attitude towards UGC platforms seems not to be reflected in actual behavior.

5. DISCUSSION

Regarding the usage of UGC, most UGC platform users are Read Only Members. The topics with which they interact are various and they are highly satisfied with all these topics (RQ1, RQ2).

There is a tendency for users to hide their real names (RQ3). From the results of the factor analysis with respect to *Personal Information* related to the traceability element of anonymity, users tend to hide, rather than display, information. On the contrary, regarding the *Linkability Factor*, users prefer to be linkable rather than unlinkable. In addition, there seems to be a tendency of separating online and offline friendships, because twice as many users prefer to keep their activity on UGC platforms secret from their friends.

There seems to be a gap between attitude and behavior in the various anonymity elements.

Firstly, attitude towards anonymity is based on the structure of anonymity. From the cluster analysis, three clusters are identified. The most dominant cluster is the “pseudonymous” cluster in which users prefer to be untraceable but linkable. The other two clusters are direct opposites. The “identified” cluster prefers to be both traceable and linkable, whereas the “anonymous” cluster prefers to be untraceable and unlinkable. Male users tend to belong to the “identified” cluster, while Female users tend to belong to the “anonymous” cluster.

Secondly, although the clusters show a significant difference in attitude towards the different types of UGC platform, actual behavior does not reflect these differences. This means that all clusters have the possibility of having both Read Only and Radical Access Members.

6. CONCLUSION

In this paper, we examined different kinds of anonymity from a structural viewpoint, and then tried to validate these from quantitative research on users of UGC platforms in Japan. Anonymity in users is not of a single kind. Linkable users may take time to grow friendships on the Internet, whereas those that are unlinkable avoid being targeted. The survey to support our anonymity classification was done only in Japan, but our structural classification of anonymity is applicable to any global services, to compare the difference of any countries.

The results of this paper will also contribute to the design of UGC platforms according to the specified purpose and targeted users. In addition, the results are applicable to privacy issues on the Internet.

This paper carried out a survey of general UGC platforms and focused mainly on the User's Interaction Layer. As a future work, we may not only include a combination of Identity treatment layers but also extend the survey to globally-used UGC platform.

ACKNOWLEDGMENT

This work was supported by a Grant-in-Aid for Young Scientists [B] (Grant No. 19700241).

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PARTICIPA: ADDING INTERACTIVITY TO LIVE EVENTS

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ABSTRACT

The project pARTicipa 22@ has been conceived as a field trial to promote and analyze novel forms of social interaction by sharing personal contents through mobile phones during live events. For this purpose, several large screens were displaced at different locations in the 22@ district of Barcelona, on the context of the festival Inside 22@, a local event of contemporary music and visual arts. The spectators could interact with a graphic application by sending SMS and MMS with their commentaries, emotions or pictures. The people attitude towards this new form of interaction was largely positive, resulting in a good participation to the field trial as confirmed by interviews and analysis of historical data.

KEYWORDS

Situated displays, social interaction, live events, content creation.

1. INTRODUCTION

Live events such as concerts, exhibitions and festivals use to capture large audiences of people sharing the same interests and expectations. People use to go to this kind of happenings as they can benefit the pleasure of an entertainment show or a leisure activity, while staying together with friends and sharing a social experience. However, would it be a concert or an artistic performance, so far a direct involvement of people in the event has been quite limited to the well known structure audience-performer (passive-active). On the other hand, the use of large displays as a means to support community-based and social activities has been increasingly explored nowadays in different settings. In addition, the users have now more widely available mobile technologies which allow them to create their own content anywhere, namely user generated content. We argue that the combination of situated public displays with simple but widely used communications media such as SMS and MMS might open up new means of self expression and sharing of personal contents. We adopted a “living lab”¹ methodology where we wanted to gather data in real settings as the main way to be able not only to validate a particular application but also to gather valuable information for future work (e.g., expectations, barriers, etc.).

The main idea behind this field trial work, pARTicipa 22@, is to allow people feel more involved and engaged to take an *active part* during live events, by creating, sending and sharing personal contents through mobile phones. Toward this goal, we designed and developed a graphic application capable of visualizing information in real-time using large displays. The application was conceived to provide useful information necessary to participate and display the contents sent by the users in different modalities, such as a photo contest and a wordcloud. As an appropriate context to explore and test our idea on the field, we chose to target INSIDE 22@, a local festival of contemporary music and visual arts arranged in an emerging city district of Barcelona.

The remainder of the paper is organized as follows. In Section 2, we present the set of goals of this investigation and discuss the related work. In Section 3, we describe the methodology that has been taken into account to perform the field trial. In Section 4, we outline the results achieved from the test and our investigation on the field. Finally, we draw the conclusion and sketch possible future works.

¹ In collaboration with CatLab – The Catalan Network of Living Labs, associated to the European Network of Living Labs (www.openlivinglabs.eu) aiming to promote innovation by involving the user in the innovation process in real life environments.



Figure 1. Picture of a concert of INSIDE 22@

2. RELATED WORK

This work roots in the large field of situated public displays. Presenting an exhaustive review of the whole area is out of the scope of this paper. For a more extensive literature review on public displays including a summary of design principles, please refer to [1]. We will focus on situated displays where the user can interact and send their own content through mobile technologies.

More specifically, research on situated displays has shown that the aim to inspire social interaction can be difficult to achieve in real life settings, and is deeply influenced by the location in which action take place [2]. From the context of content creation, arts practice and HCI have explored several configurations of mobile phone and situated display. A brief summary is reported in [3]. The same article describes *Joe Blogg*, a socially situated public display for receiving MMS and SMS, designed to be interacted with at moments of pause in people daily activities. The main finding was that, even though the system attracted lot of attention and comments, the amount of interaction was rather scarce. This fact pointed out that further investigation should be done on factors that influence the participants spontaneous interaction such as motivation, reward for participation and interface design. Moreover, an interesting research study exploring combinations of art, public display and mobile messaging is *BlogWall* [4], an electronic screen visualizing SMS in an animated manner. The application was shown in several exhibitions, finding that the attendants were thrilled to see their messages floating around the animated space, and even taking pictures at it.

These experiences demonstrated a promising potential of using public displays for enticing people to interact through mobile phones. However, it remains to be studied more deeply what factors impact and foster the interaction, *e.g.*: the relation between place and action (situated action), the role of the graphic design of the screen, the impact of incentives and rewards. In this work, we aim to consider those factors during the design phase, and try to understand the advantages and disadvantages of this form of interaction from the field, in terms of people involvement and freedom of expression of feelings and interests. An interesting experience in this sense is the *Mobile Film Festival*, an interactive film contest taking as an input only short movies filmed through mobile cameras [5].

As a first step in our research, we have started with a type of interaction using widely available technologies that today allow basic forms of user generated content (UGC) and interaction. The focus of the study reported in this paper was to understand the main variables that are valued as motivators and enablers of user participation in situated displays. We also wanted to understand the main barriers that may stop users from participating and co-participating with other users in a public event. The information gathered in this trial would be very valuable for future research were more complex ways of user participation and interaction with the group through a situated display could be tested.

In our field trial, we chose to situate the test on a live event scenario with music and concerts, where people are expected to feel rather interested and motivate to participate and possibly try out a new

technology-based form of interaction. In such a scenario, we argued that the most natural forms of interaction for the user are provided SMS and MMS, and we built a graphic application upon this input modalities. We decided to provide different modalities to allow as much as possible the participation of different people. Furthermore, in order to allow freedom of expression we designed an interface opened to three different ways of creating contents: commentaries (sending a full sentence), emotions (sending a single word), or pictures (sending a photo of the event). Our goal in the field trial was to design a system attractive and easy to use in a live event, and explore how it is received from the users by interviews on the field.

3. METHODOLOGY

As a field trial targeting a live event happening including several concerts on the street, a first design choice was to use large projected screens (320x240 cm) in order to capture the attention of the spectators. During the festival INSIDE 22@, we focused on four different locations so that the attendants could see both the contents coming from the actual venue and the messages or pictures sent in other places at the same time. Unfortunately, in two locations it was not possible to place large screens and we had only smaller LCD plasmas (of 42'' and 50'' inches).

In order to create an interactive system interesting and easy to use, we dedicated particular attention at designing the application layout, in collaboration with a graphic designer. To maximize as much as possible the participation, we chose a common and familiar input technology such as SMS and MMS from mobile phones. The core idea of the application was to inspire people participation on the event in three different modalities:

1. sending a single word by SMS to express one's emotion towards the event;
2. sending a larger message by SMS to express an opinion or a comment;
3. sending a picture of the concert/happening by MMS.

According to these modalities, we designed a graphical application with the double goal of providing all the useful information necessary for the interaction (input modalities, telephone number, keywords to include in the message) and displaying attractively the received contents. As an incentive to foster people participation, we created two contests with prizes: a picture contest, "the best picture of the event", and a lottery within all the participants who sent text messages (either words or commentaries). Unfortunately, we could not keep the cost of the messages as low as desired².

We conceived the application layout as a composition of three main screens alternating in a loop, as shown in Figure 2. The first screen, P1, provides all the information needed to participate using the three input modalities mentioned above, and an animated map of the four locations where the field trial took place. In particular, the screen provides the phone numbers to call for sending contents, one for SMS and one for MMS, and explains the message format in which the information should be sent. In order to distinguish the input mode chosen by the spectators, we selected the keywords *emo* (single word), *opina* (commentary) and *img* (picture) to be placed in the message header. The second screen, P2, is focused on the photo contest. It includes a large sized frame displaying in a sequence the pictures currently sent by the user, together with their appropriate code for voting. On the left hand side, it shows the current ranking of the contest in real time including the three most voted pictures. Finally, the third screen, P3, is a wordcloud: a dynamic composition of all the words sent by people during the event. For this latter screen, we took inspiration from the wordclouds currently used in the Internet, often taking people blogs as an input [6]. In our application, the words sent by the user rise, grow, and disappear with different character fonts at random positions on the screen. The maximum size of a word is determined by the number of persons that sent a particular word, so that the most voted emotion would be prevalent on the screen. A common feature of the three screens is a text scroll on the bottom, displaying people commentaries and information messages (e.g., about the delivery of the prizes, locations and so on). During the design phase, we dedicated a special attention at the logical and aesthetic placement of the graphical elements to make the layout attractive, and we tried to develop the same visual narrative style, common to all the three screens.

² Due to contract limitations with the service provider (0.15 euros per SMS and 2 euro per MMS).

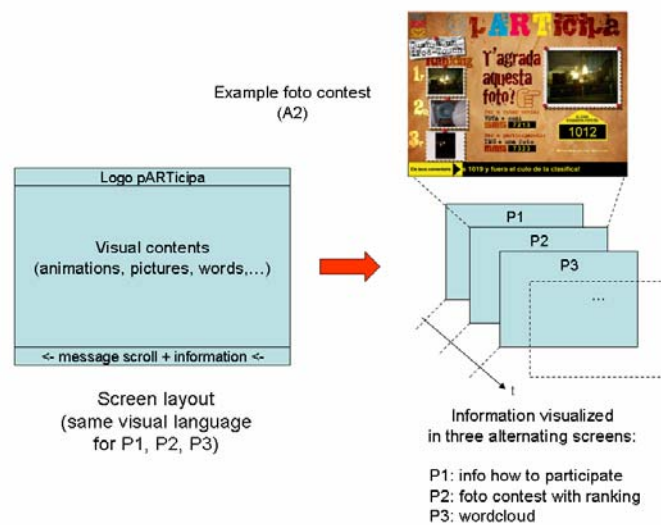


Figure 2. Application design

The architecture of the communication system is described as following. The messages are sent through a mobile connection and stored in the DB of our service provider. Then, they are collected and stored in a local project server DB (MySQL based) in a predefined format, to facilitate the visualization within the graphical application. As Internet connectivity was not present at the concerts venues (located on the street), we overcame this issue by using 3G modems to connect the application to the server DB. Technically, the application, developed in Flash, could send queries to the DB using a series of local *php* functionalities. While leaving the application open as much as possible to the people participation by providing different input modalities and allowing freedom of expression through different means of participation, we also developed a censor interface between the DB and the application, in order to skip the visualization of obscene contents (pictures or messages) in case any were received.



Figure 3. Example of screen layout (P1)

The field trial pARTicipa 22@ took place during the period of time of one night with the public displays featuring our application in four different locations at the same time, as shown in the map provided in Figure 3. A first problem we encountered was the physical displacement of the screen. We experienced that a good positioning, very important to give visibility to the application, can be quite troublesome to achieve in the contest of a live event, due to the simultaneous presence of many different actors (artists, technicians of

sound and lights, organizers, catering,...). Moreover, in two of the four locations we targeted it was not possible for logistic reasons (wind, narrow venue) to position a large screen, therefore we could only place several smaller plasma screens. Even though we solved the problem, the results of the test showed this solution not to be effective for our purpose. Another major problem we encountered was the use of MMS. In fact, due to restrictions at the service provider, for sending an MMS it was necessary to add the keyword “img” as the subject matter of the message. This operation is not straightforward with many mobile phones, involving quite a complex procedure. Moreover, some mobiles do not even allow this option. We solved this issue by adding to the application an additional information screen, describing the procedure of sending an MMS step by step. Still, it was clearly quite an awkward procedure for people attending a live event.

4. RESULTS

In this section, we highlight the major results, achievements and issues of this research work, analyzing what did happen during the field trial as well as the data gathered from interviews and historical records.

The test was conceived as a field trial happening during concert activities of the festival INSIDE 22@, starting at four locations simultaneously. During the event, two researchers were present at each location to understand people's attitude towards this new form of interaction, making interviews, and possibly give further explanations and advice when needed. The research question we tried to answer are the following:

- Did you feel taking an *active part* on the event by participating?
- Could you easily *understand* how to participate?
- Did you *enjoy* participating and why?
- Which was the *participation modality* you chose and why?

The methodology used was both qualitative and quantitative. Our main focus was to capture from the field the major features about people interaction with the application, try to understand the motivations, as well as get feedback for future works. The investigation was carried out by means of short interviews, alternated by longer interviews when the situation made it possible. Moreover, we could also analyze historical data stored on the DB to make a more quantitative study.

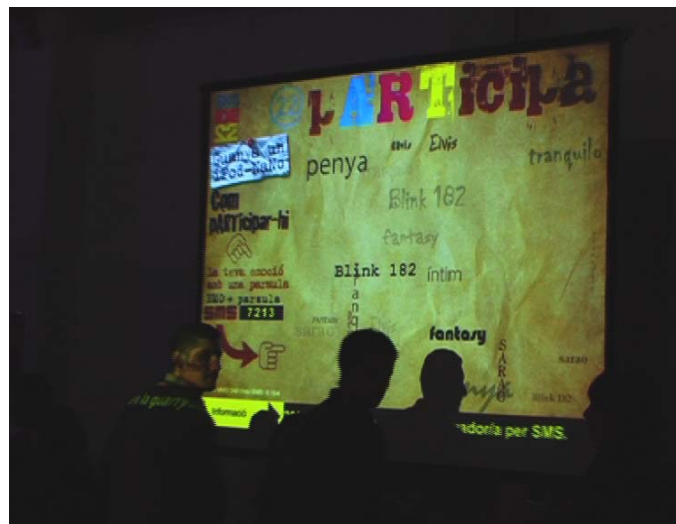


Figure 4. Example of the wordcloud (P3): people interacting during the field trial

The user interviews during the field trial have been carried out by the staff of the user interaction group of Barcelonamedia. We asked several people according with the methodology described above. In general, the people attitude towards the test was largely positive: *“I really enjoyed the possibility of participating, because it gives you the freedom to say what you want”*, as summarized by one of the spectators, a woman of 29 years old. The main motivation to participate was the freedom of expressing personal contents and see

them visualized in real time in front of a large audience: *"It was very fascinating to see my message expressed on the screen, and the fact that all people could read it"*.

An important matter that we analyzed was if the interaction could make the people feel "active part", more involved in the event. To this question we had different point of views. In general, those who participated in the test by sending SMS or MMS felt more involved; others, for instance, preferred to concentrate on the concert and did not pay attention at our application on the screen. We may argue that the success of such happenings to foster people participation as the one we designed here is very dependent from a deep integration between the particular live event activity (concert, fair, expo) and the application itself.

Unfortunately, despite our attempt to simplify the visual language and make the application as simple as possible, the majority of people reported that was troublesome to understand how to participate, and they needed help from our staff on the field. One reason is that people, though being open to experimentation, are not willing to think or learn new procedures when taking part at a leisure experience as a live concert. For most of the time the attention is focused on the stage and social activities with friend, and looking at our screen only occasionally was not enough to clearly understand what was going on. As we expected, several people pointed out that they could not understand the way to add the subject keyword *"img"* to send a MMS, and that the cost was too high (we could not avoid this procedure due to technical issues). Therefore the main barriers to the participation seem to be complexity and cost.

However, the feedback from those who took part in the test was very positive. The features of the application that people liked most are: creativity, freedom to express ideas, share contents in real time, different ways of expression, possibility of winning a prize. The novelty of the experience also played a key-role: *"I found it very amusing...it's something I had never seen before at a concert place"*, said one of the participants. Several people expressed the desire that such events could be repeated in the future.

Finally, we could also gather some useful suggestions for future works. For instance, one person said that the application could be improved by including a more dynamic layout, closely related to the contents of the concert (e.g., in this case, changing the screen layout according to the rhythm of the music). Another suggestion was to address an event at daytime for arranging a photo contest, as during the concerts there was not enough light to capture good pictures.

By analyzing the logs, during the test we received a total of 168 messages (including the votes of the picture contest):

- 38 short messages (single words);
- 17 long messages (commentaries);
- 5 pictures (photo) plus 108 votes overall.

The peak of participation was between 10:30 and 11:30 pm when more people were present at the event venues. The most used category was the single word, showing the interest of people for a simple, yet rather powerful, means of expression. Interestingly, people not only sent emotions as we originally thought the application for (e.g., *intim*), but also sent nicknames, acronyms, parts of the body, jokes, transgressions demonstrating the sake for more personal freedom (such as: *Elvis*, *Blink182*, *cabeza*, *mamarracha*, *boobs*:)). More precisely, we infer that people do not want to be constrained by a structure during this kind of activities, the original "emotion" wordcloud was replaced by a "blackboard" wordcloud. A common theme variation was the use of capital/non capital letters. Moreover, a significant number of words contained exclamations, expressing people will of "shouting" their creations as a means of more powerful expression, according to the atmosphere of a live social event (e.g., *hello!*, *party!*, *FSB!!!*).

For what concerns commentaries, also in this case we noticed that people not only sent opinions, but also use this modality as a table to share ideas, ask for explanations, make jokes, comment on other venues and so forth.

Despite the low participation to the festival INSIDE 22@, the picture contest we designed took place, and the winner received the prize for the best picture at the end of the event. As we argued, the censor interface was useful, in fact one of the pictures we received was quite transgressive. However, in the end we decided to visualize it anyway, as it was not in contrast with the spirit of the event.

The most important result of the test is that people in general gave a warm welcome to this new possibility of interaction and participated actively by sending messages and pictures. We received quite a large number of text messages but only few pictures, probably due to the high cost of a MMS and the problems aforementioned. However, the affluence of people at the concerts was quite low, promising better results with a more massive participation. Moreover, even if we paid lot of attention to explain clearly the ways of participation, a major problem was the understanding of the application, especially for what concerns

the MMS part, for the reasons described before. Finally, the lack of illumination during the concerts was quite limiting for the photo contest.

5. CONCLUSION

Despite several organizational and technical issues, the field trial has been very positive. People sent their opinions, emotions or pictures and enjoyed the pleasure of watching their contents visualized in real time on the screen, and expressed the desire of repeating the same experience in the future events. Working at this project we had to face lots of technical challenges, both during the design phase and during the test itself. Therefore as an important outcome, here we summarize the major lessons learned.

From the project coordination among different partners, we found out that several things caused stress during the development and shall be planned in advance, as we started to design the application from the user experience and the technical requirements were not fully clear in the beginning. A major problem that we encountered was the lack of communication with the provider of the telecommunication service.

From the field trial, despite some real life problems, during the event all functioned as we planned and people demonstrated lots of interest towards our application. The main problems that impacted the results were the MMS service not satisfying (costly, complex procedure for sending, not provided for all operators) and the organization of the event (lack of communication among the people coordinating the music festival, not enough promotion, last-minute change of screen positions). In fact, the main problem perhaps was that people presence to the event was very low. Moreover, we clearly noticed that the solution of relatively small plasma screens is not effective for enticing people to interact in this kind of activities.

Given the experience grown during the field trial, in future events we would focus on only one venue per time (instead of 4 simultaneously) and push for a tighter integration between a specific live event (concert, festival, exhibition), the graphic interface, and the interaction activity involved. We also will propose that the cost of the service SMS/MMS will be covered (at least partly) by a sponsor of the project or by the event organizers.

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SYSTEM OF INTERACTIVE SUSTAINABILITY AND SUPPORT FOR GOTOPS CODE – SSIGOTOPS

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ABSTRACT

A code is the written expression of the principles of ethical conduct whose function is to promote ethical behaviour. A code functions as a management tool to establish and express corporate values, responsibilities and obligations and the ethical ambitions of an organisation and/or profession. The codes of Ethics/Conduct/Practices, while strengthening the character and convictions of the collaborators, are instruments that help to construct, maintain and strengthen the culture, vision, mission, transparency and Social Responsibility (SR) of an organisation. It can help to develop sound relations with the various stakeholders, reduce the number of legal proceedings and of contingencies, negotiate conflicts of interest and ensure the fulfilment of the law. Therefore, the codes should be dynamic and not static documents. In order to achieve this dynamism so that their followers can more easily consult and understand them and find the guidelines for their key ethical problems and concerns, the necessary procedures to take into account during the process of preparation and construction of a code are relevant. For this, it is fundamental to have a model for the development process of a code that offers the necessary step-by-step guidelines for its construction, written for easy reading and understanding and with a good structure (form and content). It is a process that is accomplished by phases and requires the active contribution both from the top management and the stakeholders. The objective of the present work is the presentation of an automatic support system that permits, in an interactive manner, the sustainability of the GOTOPS (**GO**vernção **TEC**noética para **OR**ganizações **PO**rtuguesas **S**ustentáveis – Techno ethics Governance of Sustainable Portuguese Organisations) voluntary code that was created and which fully includes ethical problems raised by planning, development, management and utilisation of the IST – called **techno ethics** in this work.

KEYWORDS

Codes, development, written, form and content of a code, automatic support system, techno ethics

1. INTRODUCTION

Market globalisation raised ethical concerns that only a deep and joint interdisciplinary reflection can lessen by searching for and suggesting paths that promote awareness and consequently socially responsible ethical practices (Campos and Amaral, 2007b). Globalisation is fundamentally due to technological and political developments as they are mainly responsible for the substantial proliferation and spread of territorial connections at global level. Therefore globalisation, understood as the deterritorialization of economic and social activities, is particularly relevant for ethics in business in three essential areas – culture, law and SR (Crane and Matten, 2004).

With the support of the Information Systems Technology (IST) the possibility is open for any person to connect and interact with another one in any place in the world. In this context, one still has to add the real scenario, in this globalised society of information, of all the other dimensions – social, environmental and economic (*triple bottom line*) – supported by the technological dimension, the IST. Therefore, besides the image and reputation of all professionals of other business areas and IST users - that need IST for the development of his profession – one has to point out the image, reputation, and responsibility of the IST Professionals (ISTO) to guarantee technological sustainability.

The management of a business area, whether it is production, marketing, financial, human resources, IST or other, requires a set of activities that cover planning, implementation and control through formal and informal means. At the same time, every business management should include common typical techniques and instruments of ethics management (statements of values, CE/CC/CP, ethics committees or managers, SR programmes, among others) whose main role is the management of the ethical behaviour of the collaborators,

the management of relations with the stakeholders and the evaluation of the ethical performance of an organization. Amongst the instruments mentioned, to be pointed out are the CE/CC/CP as they are statements that explicitly outline the desired and expected conduct and practice of the professionals from the ethical point of view within an organisation or profession (Campos and Amaral, 2007a, Campos, 2006a). This practice is already quite common in many European countries and the USA (Campos, 2006b, Crane and Matten, 2004).

The elaboration and implementation of a code is not an ad hoc process (Campos and Amaral, 2007b, Campos and Amaral, 2006b, Campos and Amaral, 2007a), but a development process that undergoes the articulation of possible mechanisms for the construction and sustainability of the code and for the renovation of the energies that led to its development. In this context, the present work focuses on the presentation of the SSIGOTOPS system of automatic support to the voluntary code of techno ethics governance for Portuguese organisations (called GOTOPS), constructed and supported in a comparative analysis of the ethics codes (CE) already constructed and validated in the IST area (Campos and Amaral, 2006b); on the DIORCODES model (**DI**rectives of **O**rientation for codes - **CODES**) for the development process of a code (Campos and Amaral, 2007a); on a set of directives for writing a code and on a PROECO prototype (**PRO**otype for Structure of a Code) that provides the structure of a code (Campos and Amaral, 2007b).

2. RESEARCH APPROACH

Once the GOTOPS code was constructed, the approach followed consisted of proceeding with the development of an automatic system to support it in an interactive and user-friendly way, resulting in a uniform, dynamic and interactive code, the first in Portugal of techno ethics governance for a sustainable organisation, business and IST. In this context, the system referred to aims at promoting the responsibility and sustainability of Portuguese organisations through the involvement of its top governance bodies (Abramo, 2000, Berleur et al., 2004, Birkett and Barbera, 1999, Brown, 2003, Author, 2005, Driscroll and Hoffman, 2000, Initiative, 1998, Navran, 2003, Ricard et al., 2002, Webley, 2001).

2.1 Work Carried Out

The construction of the GOTOPS code was an integrated process of tasks (already developed and validated) supported by the comparative analysis of CE existing in the IST area (Campos and Amaral, 2006b); by the DIORCODES model (Campos and Amaral, 2007a); by the set of guidelines for writing a code and by the PROECO prototype (Campos and Amaral, 2007b) – included in the points that follow.

2.1.1 Comparative Analysis of Codes of Ethics in the IST area

When analysing the literature in the ambit of the CE/CC/CP developed in the IST areas, it was concluded that in all the prefaces the main objective is to get the professions inherent to IST to be considered the most influential in the future of our society. Besides that, the purpose of supplementary Codes and Guidelines is to serve as a basis for making ethical decisions in the conduct of professional work; they should be considered as an ethical basis for the commitment of IST Professionals in which the ethical values and standards included serve as a guide for professional conduct (Campos and Amaral, 2006b).

From the comparative analysis of 20 organisations of international reference that were studied in the IST area, it has to be pointed out that there are organisations with more than one code, i.e. CE and/or CC and/or CP in a total of 28 codes. A CE is a more condensed version that describes a set of general standards and aspirations or ideals at the highest level of abstraction, i.e. it describes the fundamental ethical principles of an organisation or profession. A CC is the complete version of the CE. A CC states how the fundamental ethical principles must be complied with, and therefore requires a higher degree of detail. Its aim is to be more rigorous in practice with a more binding character. However, there are authors that defend that CE are directed at the public and society in general whilst the CC seems to be more directly related to the IST profession. With regards to the CP, only 30% of the organisations in the sample (6/20) have CP; it can be concluded that there are few organisations with codes that govern as the person they apply to and executes his work technically (Campos and Amaral, 2006b).

The literature also reveals that many of the codes have multiple statements about the different dimensions of categories; although each one has its own structure and therefore to make it uniform is a complex matter, they have a common holistic vision of the great fundamental ethical requirements. And because each organization has its own culture, vision and mission, it would naturally result in a diversity of forms (Campos and Amaral, 2006b).

2.1.2 DIORCODES Model for the Development Process of an Efficient Code

The DIORCODES model proposed for the development process of a code includes the possibility of the code being constructed or not by the organisation, i.e. an organisation wishing to construct its code must follow the 15 steps of the model. In the case of construction of a voluntary code (not developed by the organisation), only 11 steps must be followed – 0, 1, 3, 4, 5, 7, 8, 10, 12, 13 and 14 (see scheme 1 – Appendix I). The exclusion of steps 2, 6, 9, and 11, is due to the fact that there is no leadership participation in the construction of the code (Campos and Amaral, 2007a), as the code is a voluntary one.

2.1.3 Directives for Writing a Code / PROECO Prototype for a Structure (Form and Content) of a Code

The quality of the writing and structure of a code is fundamental for the professionals to find the guidelines for their problems and key ethical concerns (Campos and Amaral, 2007b).

It is believed that the ten directives for writing (see Table 1) and the PROECO prototype for the structure of a code that were proposed, if followed with precision include what is essential to make a CE/CC/CP a critical factor of success for any organisation that desires transparency, honesty, impartiality, integrity and equity in its manner of acting, of being known and of showing concern for future generations (Campos and Amaral, 2007b). Thus, to define how to write and to structure a code, if it is CE, CC and/or CP, becomes an obligatory task before its construction.

Table 1. Directives to consider when writing a code

Proposal of 10 directives for writing a code	
(1) be clear in the language regarding the values	(6) do not use refined prose in the preliminary draft
(2) do not use clichés	(7) read the final version aloud
(3) be concise and precise in the basis	(8) make the final written version easy to read
(4) use the active instead of the passive voice	(9) validate the writing
(5) never forget who you are writing to	(10) aim for a friendly code

The key ethics, conduct and good practices statements are the core of the codes. They consist of the definition of principles and/or procedures that the organization or profession believes in and wishes to fulfil (Crane and Matten, 2004). The essential items of a code considered in the PROECO prototype are in Table 2.

Table 2. PROECO Prototype for the form and content of a code

Draft of a prototype for the form and content of a code	
1.	Explanatory and creative title
2.	Presentation of commitment from highest authority
3.	Presentation of writing and approval committee
4.	Introduction
	<ul style="list-style-type: none"> • Mission • Spirit • Purpose/Aim of the code • Context • How it should be use
5.	Key Ethics, Conduct and Specific Practices Statements
6.	Implementation and operationalisation of the code
7.	Monitorisation and sustainability of the code
8.	Disclosure of evolution of the ethical performance of the organisation

3. SSIGOTOPS SYSTEM

After the GOTOPS code was constructed (following all the stages of the work previously carried out in point 2.1) the next task was aimed at its sustainability and support in an automatic and interactive manner. It was this way that the SSIGOTOPS system appeared (**Sustentabilidade e Suporte Interactivos do código GOTOPS - Sustainability and Interactive Support of the GOTOPS code**).

The tool is a system of the web-based type and uses the Internet as communication infrastructure. Above all it is a proof-of-concept in relation to the proposed GOTOPS code. For that purpose, a system was developed based on the WEB architecture on a Database.

The SSIGOTOPS objective is to dynamise and automatise the GOTOPS code – consisting of its three codes: Code of **E**thics for the IST Professional (CE/IST); Code of **P**rofessional **C**onduct for the **I**ST Professional (CC/IST) and Code of **P**rofessional **P**ractice for the **I**ST Professional (CP/IST); thus differentiating it from all the already existing codes that are on paper.

SSIGOTOPS has a system of authentication (*login and password*) established in the database. It is thus ensured that the content of the application will only be visualized by ‘authorised’ users.

3.1 Screen Design of SSIGOTOPS System

The screens of the SSIGOTOPS system use a uniform design divided into three areas – top, centre and bottom. The top part presents the code under consultation – title, symbology (Figure 1) and subtitle inspiring the ethical behaviour.

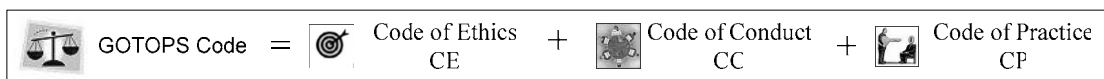




Figure 1. Symbology of each code

On the left side of the middle section are the different items that make up the codes and on the right there is an area to visualise the content of the item selected. At the bottom, the purpose of the three support buttons is to inform the user as to how to use the code, its terminology and printing option; the three icons (Figure 1) permit immediate access to each code at any moment.

Whenever the user wishes to return to the previous screen or go to the following one, he should use the browser options  and .

It has to be pointed out that all the codes use the PROECO prototype for its structure. The result is a uniform screen design for all the codes.

3.2 SSIGOTOPS - Walkthrough

Once the tool has been started (through the introduction of the address in the *browser*), the first screen of the GOTOPS code appears (Figure 2). In this *homepage*, when the user clicks on any area of the screen the system asks for his authentication – *login and password* – in order to have access to the code itself.



Figure 2. First screen of the GOTOPS code (*homepage*)

When the process of authentication is concluded, the main screen of the GOTOPS code appears, already with the visualisation selection of its mission (Figure 3).



Figure 3. Main screen of the GOTOPS code

To visualize the abridged versions of each of the codes (CE, CCP and CPP), the user must select the respective item of each of the codes (Figure 3). The screen corresponding to the selected code will appear (Figure 4, Figure 5 and Figure 6). If the user wishes to enter one of them directly, he simply has to click the icon with its symbol.

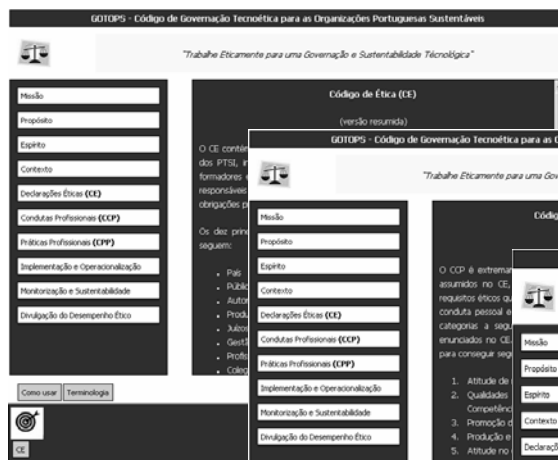


Figure 4. Abridged version of the CE

Figure 5. Abridged version of the CC

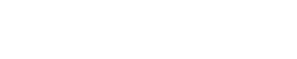


Figure 6. Abridged version of the CP

It has to be pointed out that the different colour backgrounds aim at mnemonic polychromy. All the screens of the GOTOPS code have a red background and those of the CE/CC/CP a yellow background (Figure 7, Figure 10 and Figure 13).

To have access to the CE the user must click on the respective icon and the main screen of that code will come up (Figure 7). For example, if the user wishes to visualise the fundamental ethics statement of the profession, he must select the 'Profession' item (Figure 8). To visualize any one of the other ethics statements, the process is similarly repeated. If the user wishes to visualise all the ethics statements at once, he must select 'All' (Figure 7) and the screen will come up (Figure 9).

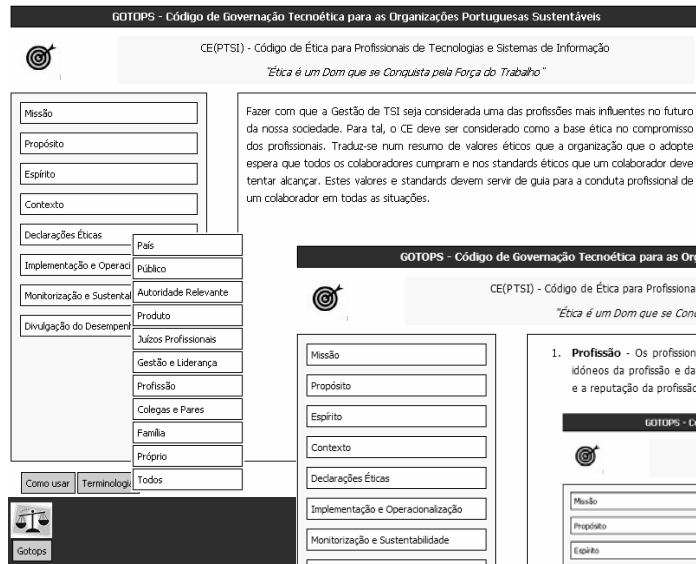


Figure 7 Structure of CE (already with the selection of items: 'Mission' and "Ethics Statements")

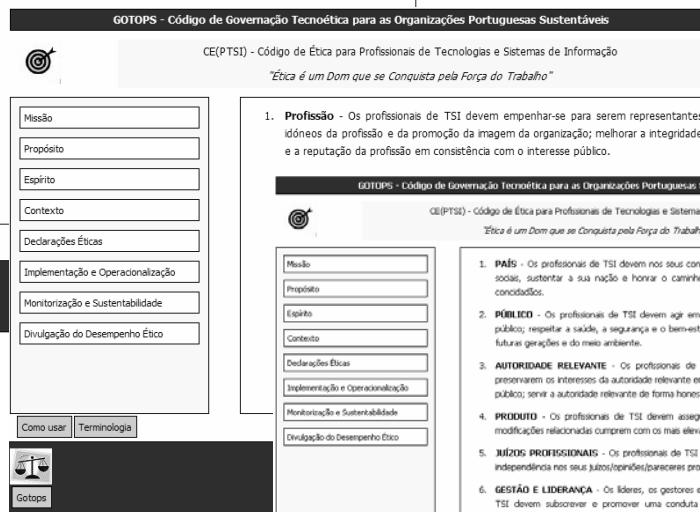


Figure 8. Ethics Statement for 'Profession'

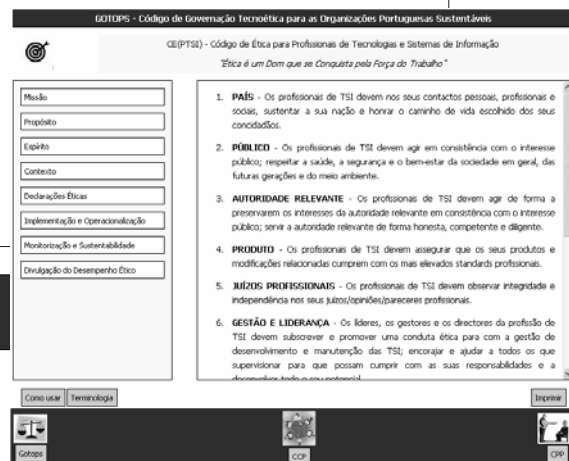


Figure 9. Visualisation of all 'Ethics Statements'

The professional conduct to be followed in order to comply with each of the ethics statements of the CE can be found in the CCP. To visualise it, simply click the icon of the CCP and the main screen of this code will come (Figure 10).

After the example mentioned above, the item 'Profession' is selected and immediately, and in a filtered manner, only the conducts to be followed in the profession will be presented (Figure 11).

It is to be pointed out that in the screen of Figure 11, the fundamental ethics principle appears again ('Profession' in this case), so that the user will always have it present when he consults the professional conduct necessary to obey that principle. This way, it is more user-friendly to assimilate the ethical conducts to be followed.

If the user wants to visualise all the professional conducts defined by the CCP, he simply has to select the item 'Categories' (Figure 10).

When comparing, for example, the conduct 'General attitude of respect' of Figure 11 with that of Figure 12, it can be seen that there is a filtering process that the SSIGOTOPS easily manages. Whilst Figure 11 only shows 'Respect for the prestige and promotion of the profession', Figure 12 shows all types of respect included in the CCP ('Respect for the interests and rights of all people involved'; 'Respect for social well-

being and public health, the environment and quality of life'; 'Respect for the quality of life of the people involved' and 'Respect for the well-being of the Society of Global Information').

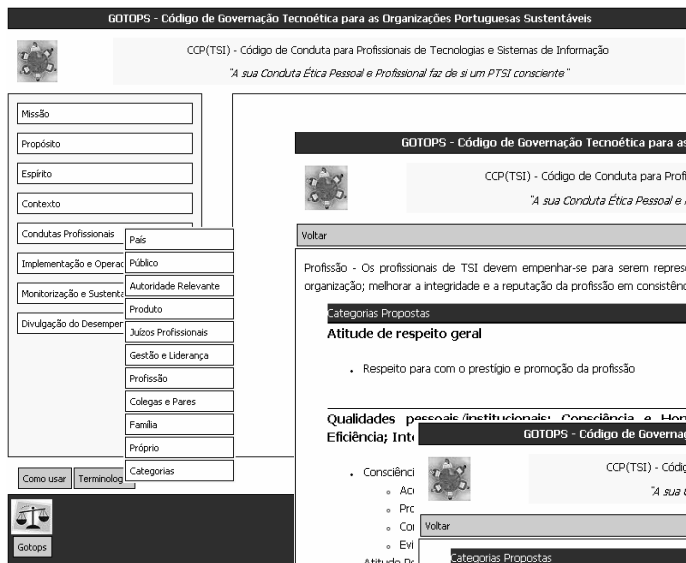


Figure. 10. Structure of CCP/IST (already with the selection of the item 'Professional Conduct')

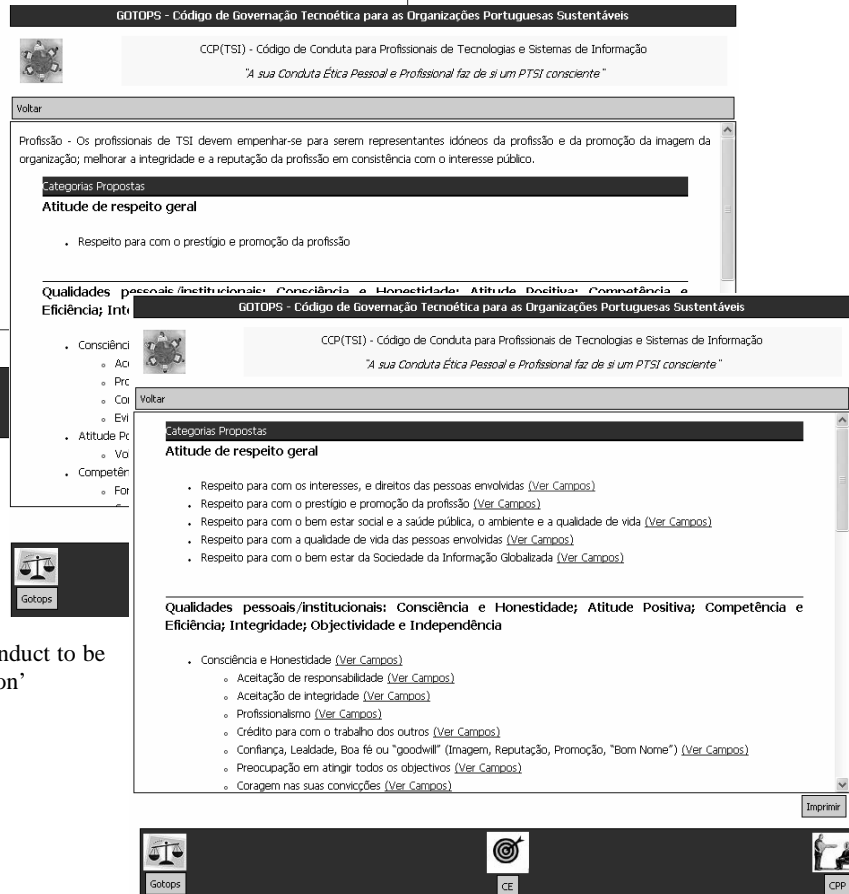


Figure 11. Ethical conduct to be followed in 'Profession'



Figure 12. All the ethical Conducts

If the user wants to consult the good professional practice so as to ethically carry out his competencies and skills, he simply has to click the respective icon at any moment and the main screen of the CPP (Figure 13) will show up.

If the ISTP, for example, is an IS manager, he should select the organisational competency 'Development' that, in a structured manner, classifies the necessary operational competencies and professional skills (Figure 14).

When he selects the skill 'Management of Systems Development', the ISTP visualises all the good professional practices to be followed for techno ethical performance of his operational ('Systems Development') and organisational ('Development') competencies.



Figure 13. Structure of the CP (already with the selection of its Mission and Professional Practice)

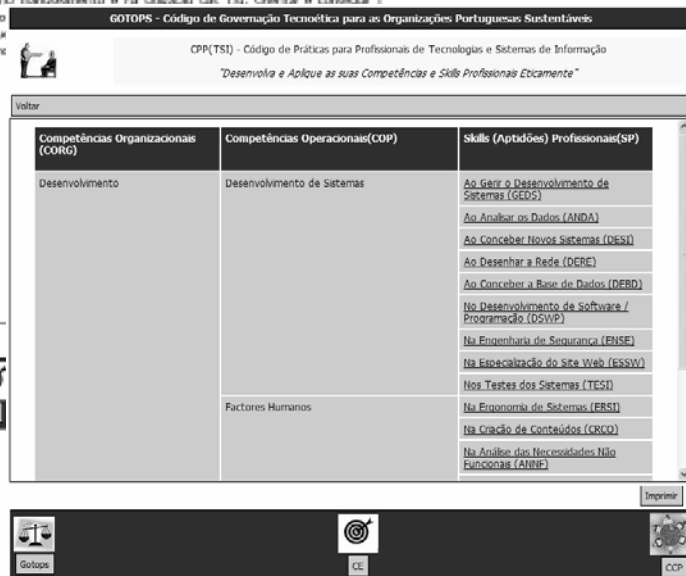


Figure 14. Skills Professionals of the Operational ('Systems Development') and organisational ('Development') competencies.

3.3 Empiric Validation

The SSIGOTOPS system was validated through a real case study taken from the literature, aiming at the access, handling and utilisation of the GOTOPS code in an interactive and automatic manner.

4. CONTRIBUTIONS

The sum of the contributions obtained with the development of the research work carried out made it possible for the proposed mission and vision to be accomplished.

Mission: create a code of techno ethical governance for the ISTP and help the Portuguese organisations to adhere to technological sustainability without having to spare dedicated collaborators exclusively to its elaboration.

Vision: sustainability and automatic and interactive support of the code, so that in a simple and friendly manner the ISTP of any one organisation can easily and frequently consult it whenever in doubt or in need of clarification with regards to the techno ethical conduct and practice to be followed in the exercise of his IST profession.

The fundamental contribution of this study consists of making the GOTOPS code the first code for consultation, updating, and automatic handling in Portugal. As all the existing codes are in paper, that explains the strictness and low rate of consultation and knowledge of those codes.

5. FUTURE WORK

For the future, we propose right now the translation of the code to the universal language (English) and the progressive and continuous improvement of the GOTOPS code and the SSIGOTOPS system.

6. CONCLUSION

The fact that the GOTOPS code supports ethical decisions through sustainability and automatic support permits emphasising the analysis of real situations that involve a variety of topics (e.g. 'Intellectual property', 'Privacy', 'Confidentiality', 'Quality of the Professional work', 'Justice and discrimination', 'Risks caused by software', 'Conflicts of interest', 'Non-authorised access') that demand ethical positions and that are ever more present in the lives of the organisations and professionals.

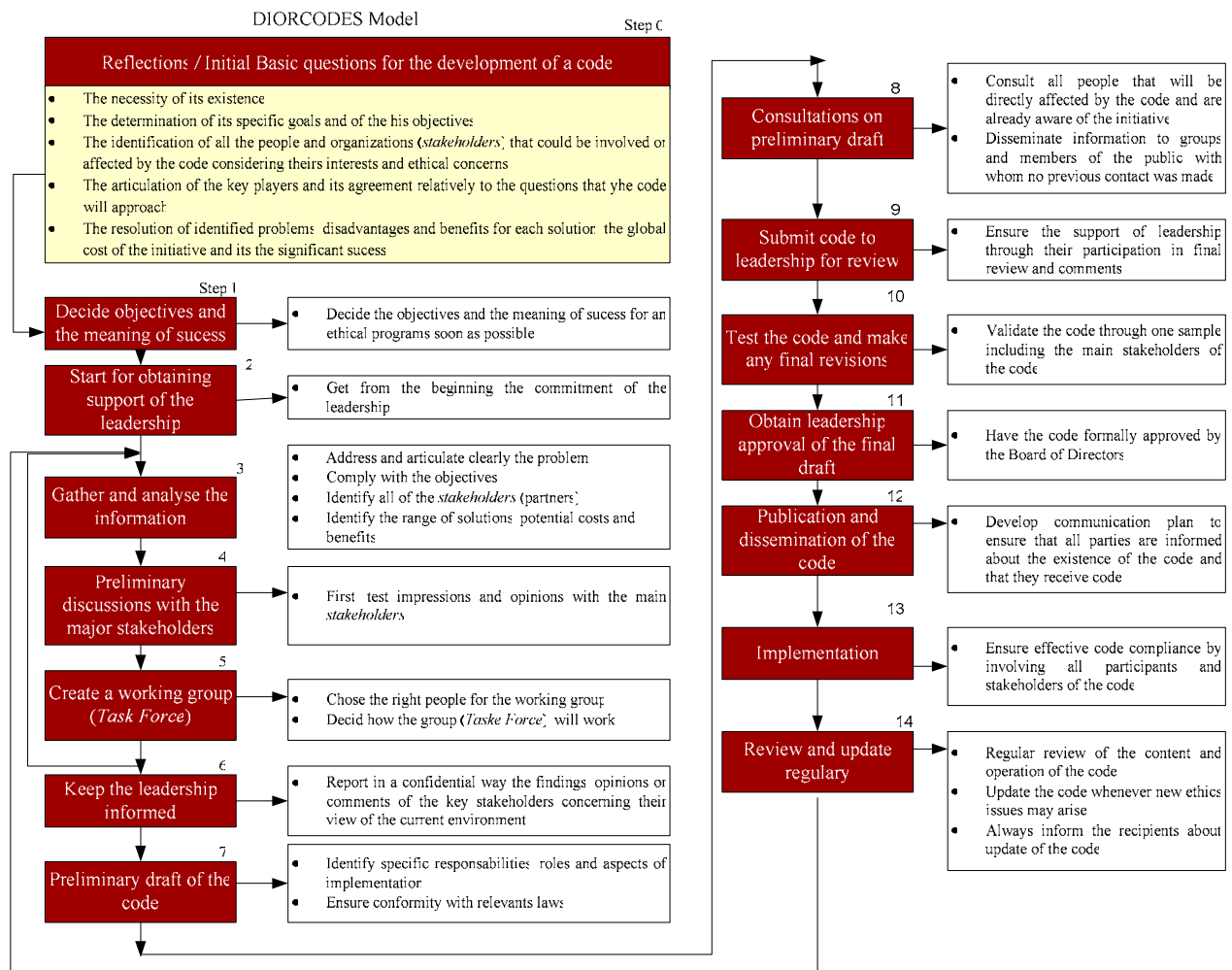
As the first voluntary code of techno ethical governance in Portugal, this code is not simply to judge the nature of questionable acts; it also has an important educational function. As it thoroughly and completely expresses the rules and behaviours about techno ethical issues, it is a means for educating students, users, ISTP and trainee professionals about the techno ethical obligations of all.

The SSIGOTOPS system aims to be dynamic in the sense of constant updates and because it is automatically supported, those updates may be obtained much more quickly and efficiently. These updates come from the utilization of the code itself, whether in organizational, academic and/or scientific (research) environment.

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APPENDIX 1



ICT COMPETENCES FOR ONLINE UNIVERSITY STUDENTS

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ABSTRACT

The Digital Literacy Area from the Open University of Catalunya (UOC) identifies the ICT generic competences and skills that students should acquire at university level in order to keep up with current information society. In this paper it is described an example of the activities carried out in the Digital Literacy subject that help students to acquire the aimed competences. Results of a questionnaire answered by students on their perception of having acquired these competences are also presented.

KEYWORDS

ICT Competences, Digital Literacy, Net Generation, EHEA.

1. INTRODUCTION

The Open University of Catalunya (UOC) is a fully online university which was created in 1995 to provide distance learning at university level. UOC has a Digital Literacy Area that aims to work on the skills related to ICT which are key aspects in today's information society. It offers a subject at cross-curricular level, in graduate and post-graduate studies and it also provides specific trainings.

Bearing in mind that the cultural, social and technological changes in today's information society have undoubtedly changed the profile, characteristics and needs of the so called new generation of students, UOC Digital Literacy Area has carried out a research to identify the generic ICT competences and skills that students should acquire at university level, as well as to explore how can we help them to acquire them. A first proposal was identified by the Digital Literacy Area and later on was evaluated by UOC students in order to corroborate it.

2. INFORMATION SOCIETY

The introduction of new technologies in today's society and in education has certainly changed students' needs, goals, and skills. The impact of information and communication technologies implies that one cannot assume that today's students are the same as previous generations and hence new appropriate methodologies need to be introduced to provide students with the necessary skills to keep up with current society and its changes, that is, to become digital literate. This implies redefining the parameters of traditional Higher Education.

By Digital Literacy it is understood the ability to use digital technology, communication tools or networks to locate, evaluate, use and create information. It involves the "confident and critical use of Information Society Technology for work, leisure and communication. It is underpinned by basic skills in ICT: the use of computers to retrieve, assess, store, produce, present and exchange information, and to communicate and participate in collaborative networks via the Internet" (Recommendation of the European Parliament and of the Council on key competences for lifelong learning http://ec.europa.eu/education/policies/2010/doc/keyrec_en.pdf). It is

a key aspect in today's information society and to acquire such competence means to acquire a net team methodology. We understand that technology is not only a tool but the context. It goes further that the simple instrumentality to put into practice knowledge (Martin, A. I Grudziecki, J. 2007).

By new generation students we are not just referring to those born within the ICT society, that is students who were born in the 1980s or later (Oblinger, D.G. 2005), but also those citizens that thanks to new technologies have access to education. Online environments allow us to break time and space barriers and this implies that people can study no matter their age, where they come from, or their working schedule. In this sense, High Education students' description would not only include those coming straight after their high school studies but also adults who may have already other university studies, people who work and study at the same time; in short, individuals that wish to study as part of the concept of Lifelong learning. This is actually the background of the students who decide to study in an online university such as the UOC. This concept of Lifelong learning is nowadays "part of the vocabulary of the industrialized world. It describes the need for people to continue their education and training throughout life because they will face multiple careers in changing economies and enjoy longer lives in evolving societies..." (McIntosh, C. 2005). By making learning possible to a wider audience, we are undoubtedly enriching our society.

Internet has opened up new possibilities among students and is a huge source of information. The problem now is not to know where the information is stored but rather how to find it, filter it, use it and present it. New skills need to be acquired in order to take full advantage of all potentialities. The educative system is getting centred now on learning rather than teaching; therefore students must be provided with the maximum skills and abilities to make them, in this sense, as autonomous as possible. Whereas in the past students' role was more receptive nowadays they become active subjects, connected to the idea of learning by doing. These net generation students value experimental learning, working in teams and social networking. This implies that students not only learn the content but also, and most particularly that they acquire a set of skills to learn and work in the information society. Learning outcomes are expressed in terms of the level of competence to be obtained by the learner. Competences represent a "dynamic combination of cognitive and meta-cognitive skills, knowledge and understanding, interpersonal, intellectual and practical skills and ethical values" as highlighted in the "Tuning Educational Structures in Europe" project.

3. BOLOGNA PROCESS

The Bologna process aims to create a European Higher Education Area (EHEA) by 2010 and give the citizens "the necessary competences to face the challenges of the new millennium, together with an awareness of shared values and belonging to a common social and cultural space" as claimed in the Bologna declaration preface.

The common European educative approach puts emphasis in an education based on the learning and on the skills and competences that students develop along the learning process which will allow them to progressively update their knowledge all through their lives. It is aimed also to increase mobility of students across Europe by establishing joint programmes, offering degrees by institutions from different countries and adopting a system of easily readable and comparable degrees. This can be done by agreeing on the skills, abilities, competences and learning outcomes to be achieved in Higher Education.

The report "Tuning Educational Structures in Europe" (González, J.; Wagenaar, T. (2006) brings together the reflection and conclusions of professionals of Education from all Europe on what competences students should attain at university level. These have been classified into subject-specific competences for university degrees, which describe learning outcomes and generic ones which prepare students well for their future role in society in terms of employability and citizenship.

Generic skills have been classified in the report into three main categories, as shown in the table above:

- Instrumental: those that have an instrumental function
- Interpersonal: those related to the capacity to express feelings, critical and self critical abilities
- Systematic: those related to the ability to plan or redesign planning.

Table 1. Generic competences classification

GENERIC COMPETENCES	
INSTRUMENTAL	<ul style="list-style-type: none"> ○ Capacity for analysis and synthesis ○ Planning and time management ○ Basic general knowledge ○ Grounding in basic knowledge of the profession in practice ○ Oral and written communication in the native language ○ Knowledge of a second language ○ Elementary computing skills ○ Information management skills ○ Problem solving ○ Decision-making
INTERPERSONAL	<ul style="list-style-type: none"> ○ Critical and self-critical abilities ○ Teamwork ○ Interpersonal skills ○ Ability to work in an interdisciplinary team ○ Ability to communicate with non-experts (in the field) ○ Appreciation of diversity and multiculturality ○ Ability to work in an international context
SYSTEMATIC	<ul style="list-style-type: none"> ○ Capacity for applying knowledge in practice ○ Research skills ○ Capacity to learn ○ Capacity to adapt to new situations ○ Capacity for generating new ideas (creativity) ○ Leadership ○ Understanding of cultures and customs of other countries ○ Ability to work autonomously ○ Project design and management ○ Initiative and entrepreneurial spirit ○ Concern for quality ○ Will to succeed

The EHEA also places great emphasis on group work as it fosters active and participate learning since it is the student who constructs and exchanges knowledge. Teamwork is actually one of the most highly valued workplace skills.

UOC has already adapted most of its studies and subjects to the Bologna process, focusing on the competences that students acquire on the active learning process (including group work), introducing tools

and resources that help acquiring those competences and bearing in mind the profile of new generation students. The subject of Digital Literacy is a clear example of this.

4. UOC DIGITAL LITERACY SUBJECT

UOC educational system is based on the concept of a Virtual Campus, which is supported by a communication network that overcomes time and space barriers and provides a personalized contact between students. The student is placed at the centre of this educative model as exemplified in the figure.

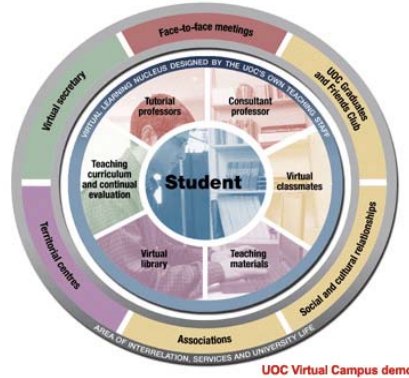


Figure 1. UOC Educational system

The UOC offers the subject of Digital Literacy to over 3500 students per semester. This subject has evolved all through its eleven years of existence at the same time that new technologies have. Also, it has been adapted to fit the objectives of the EHEA, hence it is based nowadays on the competences that students acquire in the subject. At present time, the subject, Digital Literacy, aims to provide students with generic ICT skills to work and study in virtual environments. It is a cross-curricular subject which is taken in the first semester at the university as it aims to provide students with generic ICT skills necessary for working and studying in virtual environments, both in relation to their own degree area and in general contexts. Also, it puts great emphasis in team work and collaboration among students. All these competences will be needed by the students to take other subjects along their studies at the UOC. Digital Literacy subject is been inspired by the Bologna agreement on High Education, fitting in the new education paradigm focused on the net generation student. The learning process of the subject is focused on the activities carried out by the students and the competences that they acquire while performing them.

4.1 ICT Skills and Competences

The subject of Digital Literacy takes into account the changes in society, new technologies, ICT, new ways of education and the wide-ranging students' profile. For this reason, it aims to provide its students with cross-curricular competences to keep up with nowadays information society. By competence is understood the complex system actions that integrate knowledge, practical skills, attitudes, value orientation, emotions and other behavioural components that together can be mobilized for effective action.

The aimed competences are put into practice and acquired progressively by the students along the semester. These competences have evolved from those generic ones identified in the Tuning project and been adapted to the UOC scenario and the information society. They are the following:

- To search, select, collect and retrieve information in digital environments. This includes the ability to identify likely digital information sources and to get the information from those sources, by searching through database and browsing through linked web sites.
- To communicate information properly in the framework of a learning community. This includes the ability to adapt electronic information for a particular audience and be able to communicate knowledge and to acquire a virtual communication style
- To plan, organize, and classify (digital) information as well as virtual work and study.

- To analyse, interpret, process, manage and represent (digital) information, which includes contrasting information and synthesising it.
- To determine the degree to which digital information satisfies the needs of the required task, that is to acquire a critical thinking which determines the relevance of information found.
- To present information using different ICT tools and resources.
- To acquire online teamwork skills to be able to work in groups, which implies skills related to problem solving, decision making, interpersonal relations.

4.2 ICT Methodology and Tools

With the ultimate aim that UOC students acquire the necessary generic ICT skills, some tools, resources and methodologies have been introduced in the subject of Digital Literacy, especially those that foster collaborative work. Carrying out online group projects and using Web 2.0 technologies are nowadays part of the subject which has evolved at the same time as new technologies have.

An online group project has been designed and implemented in the Digital Literacy subject so that students acquire progressively the aimed competences. Students are asked to group themselves in teams of 3 or 4 people and together they have to not only create an online project but also organize themselves to do so, as well as organize their time and work. The project is divided into different stages which are assessed at the end of each one by the teacher, by the student himself/herself and by the team member as a group so that allows them to improve the process in each stage (Guitert et al., 2003).

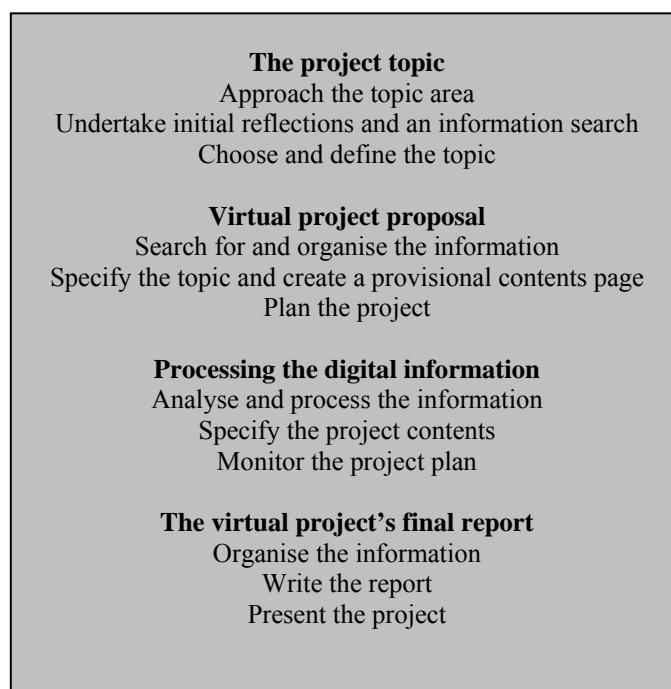


Figure 2. Stages in a virtual project

The process allows students to acquire some skills, attitudes and competences that are established by the EHEA and by the Bologna Declaration and which are considered key elements in today's net society, such as team work, critical and self-critical abilities, problem solving, decision-making, etc.

The introduction of social software Web 2.0 has allowed users to become active actors and that provides huge possibilities in education. Its social nature supports students' collaboration and interaction. Resources such as blogs, wikis and blikis can be used to build up knowledge collaborately as they allow students to interact, share information, reflect together and create understanding jointly and hence they are a mean for learners to acquire and reinforce ICT competences. They also support the creation of ad-hoc learning

communities by facilitating critical feedback with discussion threads from both from teachers or peers. Web 2.0 supports queries for information and reflections on any topic of all sorts.

The fact that most new generation students are already familiar with Web 2.0 in their ICT use at home facilitates their introduction in education.

4.3. Assessment Process

The subject is based on a methodology of work by a project that involves a process of continued and progressive learning through the accomplishment of a set of activities that are related to each other. The evaluation is based on the continuous evaluation from a series of activities that assess the learning process. The achievement of each stage of the online project is linked to an assessment activity that need to be understood globally as they are all linked and related among them. Student hand in an online group project, as a result of their work, which they have been working progressively along the semester (Guitert. M. Romeu, T. 2008)

Apart from the assessment and feedback students receive by the teacher during all group work process, students carry out a self assessment and a group assessment, at the end of the subject, where they are forced to evaluate and reflect on several aspects, such as their acquired competences, the group work process, results achieved and outcomes. All this information helps teachers evaluate their students and it complements the assessment made by them, in fact, in most cases, it just a corroboration and confirmation of the evaluation previously made by them. Even though there is a group assessment, students receive an individualized qualification. This qualification is the result of the outcome/ product plus the analysis of the student's individual process within the group work (his/her attitude, contribution, interaction...).

5. QUESTIONNAIRE RESULTS

UOC Digital Students answered a questionnaire at the end of the semester on several issues related to the subject and, most specifically, to their self assessment on the acquisition of the main competencies worked along the subject. These competences were mainly grouped into information management (exchange of information, organization of information,...) , planning and organization (ability to organize work and time, group organization, ...), communication and interaction (communicative style, ability to take decisions,...) and attitude (commitment, willingness to disclose information,...).

The data gathered during the semester February-June 2007 reinforce a good valuation by the students of the competences put in practice in the subject. A 27% of the students (998 students), who registered for the subject, answered the survey valuing their degree of acquisition of each one of the ICT competences (see table above). This valuation on the subject is part of the subject closure. 96.85% of the students consider that to work the subject through a virtual project methodology has helped them acquire the generic competences in ICT.

Table 2. Valuation of the students on the acquisition of each one of the ICT competences worked during the subject

Competences	Valuation
Virtual communication style	99,28%
Management of a virtual project	98,17%
Search and selection of information in network	96,45%
Analysis, treatment and interpretation of digital data	96,35%
Elaboration and structure of digital information	96,55%
Presentation of the digital information	96,55%

In addition to the data gathered in the subject questionnaire, an institutional survey was passed to the students on the same semester (February- June 2007). 785 out of 2728 students (21,4%) answered the survey, a fact that allows us to obtain valid and generalize information on the degree of satisfaction of the students.

Table 3. Valuation of the students on the quality indicators of the institution

Quality indicators	Valuation
General satisfaction of the subject	76,03%
Global assessment of the virtual teacher	90,34%
General satisfaction of the learning resources	77,13%
General satisfaction of the evaluation model	86,99%

6. CONCLUSIONS

Before starting at the university most students are already familiar with the use of ICT in their daily lives but they still need to transfer such skills from their daily life to their learning. UOC students are considered part of the net generation students in the sense that they are studying in a fully online environment, taking full advantage of ICT tools and resources and acquiring progressively a set of generic ICT skills and competences.

The questionnaire results show that ICT competences worked along the subject have been acquired by the majority of students. They also reinforce the fact of putting into practice these competences at the beginning of any study at the UOC. In this sense, the added value of the competence of use and application of the ICT in the academic and professional environment, and at the UOC, is that it starts in the compulsory subject, reinforced throughout the degree, and consolidated in the Final Work of Degree. Following this methodology, we aim to continue analyzing the level of achievement of the ICT competences to value the global acquisition of the competences since the beginning of the studies to the very end.

It is responsibility of universities to prepare students for today's society and train them to be part of the net generation, taking fully advantage of the evolution of the current study plans towards the EHEA. Students need to integrate ICT in their learning process and acquire critical and rational use of them and a certain degree of competences to be able to managed ICT.

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EDUKNOWLEDGE-AN USEFULL TOOL FOR E-LEARNING, KNOWLEDGE BASED, CONTENT DESIGN AND DEVELOPMENT

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ABSTRACT

The paper presents the most significant aspects of a research performed by INCDPM "Alexandru Darabont" and oriented towards the development of a highly efficient and optimal e-learning tool for technical domain. A framework for knowledge elicitation, procesment and effective dissemination and storage for future use is the key of the e-learning process. The e-learning process uses intensively a specific structure called eduknowledge, structure that allows the partition and procesment of domain intensive knowledge into educational oriented cluster.

The approach was tested on 5000 Romanian students and proves to be very efficient as a future for technical e-learning.

KEYWORDS

E-learning, eduknowledge, content, cluster, development tools

1. INTRODUCTION

Knowledge is, perhaps, the most precious asset for every developed society. Knowledge refinement and processing towards learning is a tedious work asking for a lot of resources. However, if the knowledge is not processed and is not learning-ready the user will be bored in a very short time, perhaps loosing what is essentially needed for the unimportant knowledge. This is a most important aspect when the e-learning process is focused on occupational safety matters. If the student does not learn about how to perform safely an activity- being feed instead with theoretical aspects- he could easily be involved into an unpredicted event, incident or work accident. Even if he is not injured there could be loss of property or/and adverse effects upon the environment.

In this respect the paper presents some last hour aspects regarding the research and implementation of an e-learning tool called eduknowledge.

Combining an authoring tool and an expert system shell the eduknowledge instrument allows the development of eduknowledge clusters, knowledge based educational units specially tailored in order to efficiently teach specific skills.

Developed initially for safety purposes only, eduknowledge could be used in all the technical disciplines and not just there. It allows the development of a specific framework which helps the developer:

- to acquire new knowledge;
- to process this knowledge into educational efficiency-oriented clusters;
- to "feed" these clusters to the student and fine-tune them on the basis of the received feedback;

The paper:

- presents the main concepts regarding eduknowledge and eduknowledge clusters;
- presents some significant results regarding the extensive testing of the prototype developed upon more than 5000 Romanian students-managers of construction SME.

2. EDUKNOWLEDGE AND E-LEARNING

Eduknowledge is a general concept, meaning knowledge specially prepared for educational purposes. Eduknowledge clusters are well defined structures that could optimize and maximize the efficiency of e-learning activities when such activities are oriented towards skill achievement. Mainly, eduknowledge is composed by an eduknowledge frame, optimized especially for achievement of specific learning performance parameters and eduknowledge content.

2.1 The Framework of Eduknowledge

The eduknowledge framework is generally implemented by an authoring instrument –for our prototype we used ToolBook 9.01 but any other instrument such as Lectora or Authorware could cope. The eduknowledge cluster developed by this module contains a static part-the main and essential body of knowledge needed to acquire the skill together with links towards the dynamic part of the eduknowledge-interactive applications that should give the learner the ability to master the new acquired skill. This dynamic part was implemented in our prototype using an expert system shell. We found this tool as very useful because the dynamic parts developed for learning could be further developed-if needed-into decisional assistant systems. Figure 1 shows schematically such a framework.

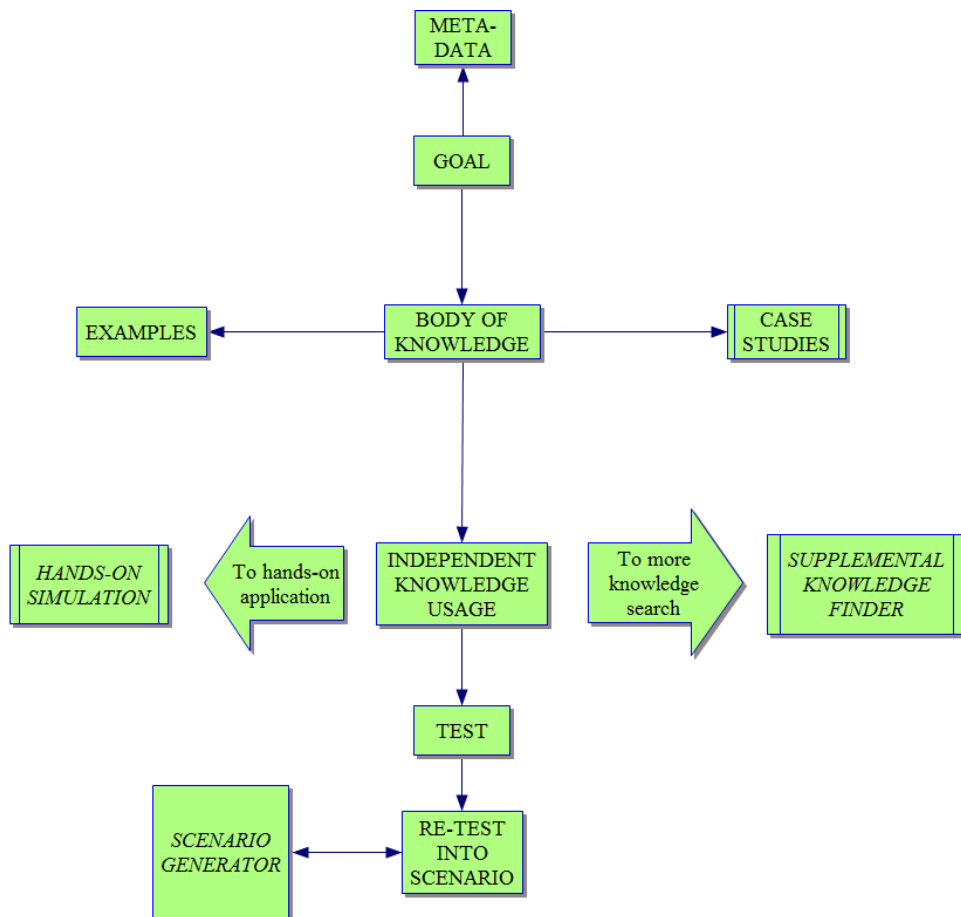


Figure 1. Eduknowledge framework

Case studies are the start-up of knowledge based education- hands on simulation generator and supplemental knowledge finder being case centered. The body of knowledge is goal centered, and so is also the meta-data.

The most important aspect regarding eduknowledge is represented by the processing of knowledge into specially goal oriented structures, process showed in the next paragraph.

2.2 Knowledge Processment into Eduknowledge

Knowledge processing needs to introduce mechanisms to identify and incorporate users' knowledge that could be helpful in explaining the bi-lateral adaptation, customization and modification. In this respect, in our research, „The Object-Mediated User Knowledge Elicitation”- OMUKE was the main method being proposed as a way to capture user knowledge that helps eduknowledge design teams to develop clear insight into user needs and use context. The OMUKE method relies of context of events and incorporates elements of user observations and the Converging Perspective Method, leading to a systemic decomposition of the interesting field of knowledge. The method used triggered mechanisms to externalize user knowledge. The figure 2 shows the adapted OMUKE used for this project.

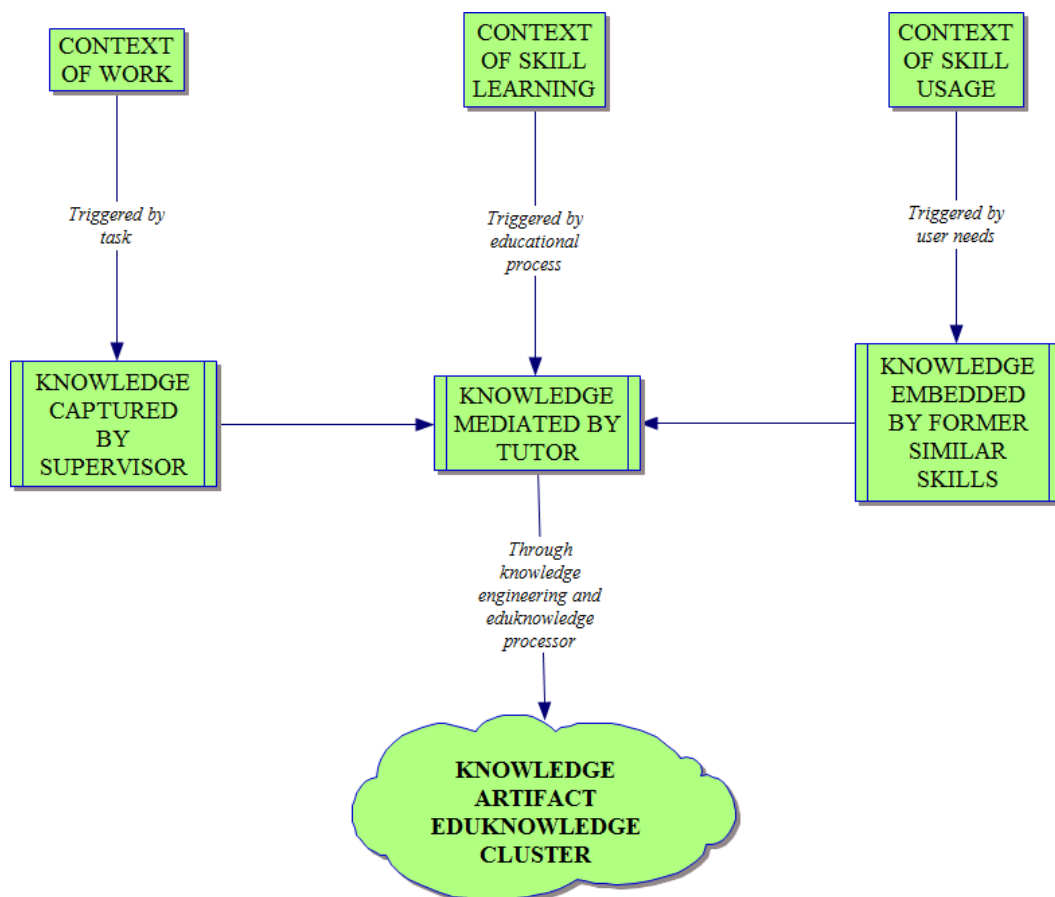


Figure 2. Adapted OMUKE

The main steps in processing the knowledge are:

- analysis of the domain;
- knowledge elicitation by expert;
- concept mapping;
- development of knowledge model;

- Identification-based on the knowledge model- of activity related essential knowledge bits-AREK- (for example-steps of a specific task performing)
- Functional ordering of AREK-this structure will be the pillar of the eduknowledge cluster;
- Evaluation of the other domain knowledge- for every part of operational knowledge there will be given a mark. Depending on the obtained mark (attributed by an expert or by a panel) the knowledge will be used (or not) in various postures, like in the table.

Table 1. Marks and knowledge repartition for use

Mark	Knowledge usage
5	Hands-on interactive approach on scenarios derived from the knowledge domain
4	Test and re-test subject
3	Case study
2	Example
1	Addendum

Generally, for operational purposes are used just the parts of knowledge marked 5 and 4. When the eduknowledge goal is larger there could be used all the knowledge.

2.3 Development of an Eduknowledge Cluster

An eduknowledge cluster contains both essential(static) knowledge- the knowledge needed for mastering the skill and dynamic knowledge- interactive objects which serve as hands-on training and, depending on the complexity of the problem being analyzed could be developed till decision-assistant expert systems.

The essential knowledge is included in the eduknowledge frame, frame developed with one of the authoring instruments available. We have chosen ToolBook 9.01 as the handiest instrument from our experience. ToolBook 9.01 gives the opportunity to disseminate off-line- using its run-time and also to build an on-line dissemination in DHTML form.

The interactive objects could also be built in ToolBook. However, we have chosen for our prototype an instrument called VisiRule (built under Flex for Windows -a LPA-PROLOG application). VisiRule allows the design of hands-on training on the spot, by simply charting the model of the problem and generating automatically code.

Figure 3 presents such a chart, developed for this paper.

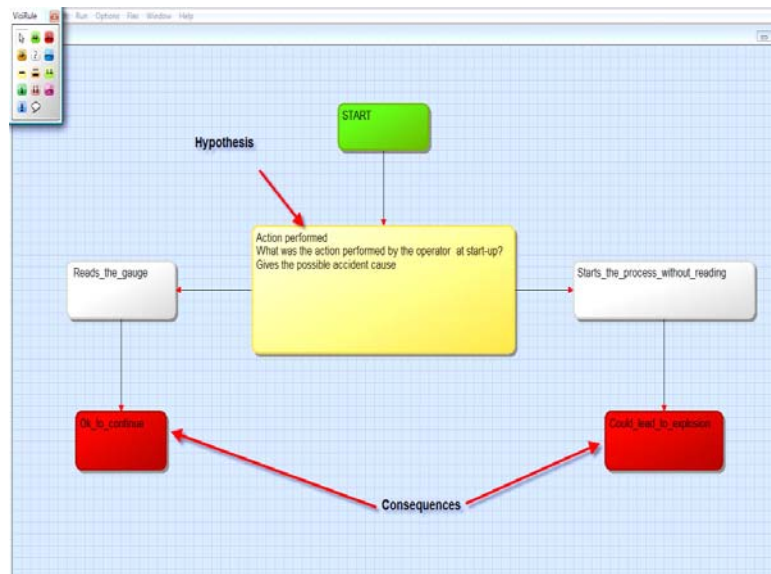


Figure 3. The VisiRule chart

Figure 4 presents the generated code. It could be observed that, at this point, the hands-on example is ready to run.

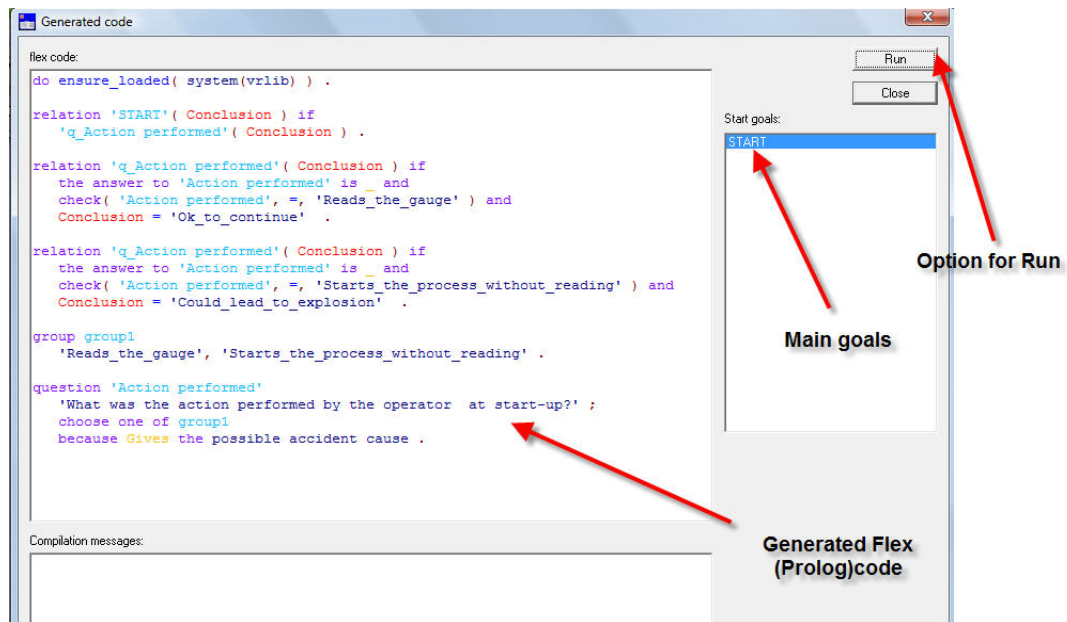


Figure 4. Generated code

Figure 5 presents the beginning of running. The student must choose (depending on his knowledge and mastering of the skill) one of the two (eventually, in more complex examples, multiple) actions.

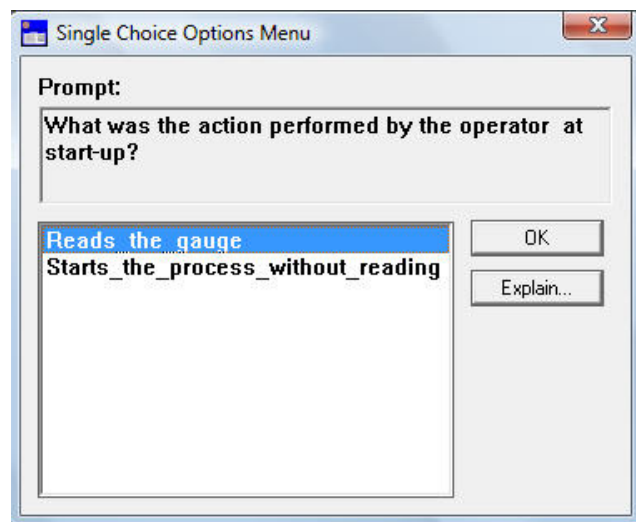


Figure 5. The initial running step of the hands-on example

It could be seen that an eduknowledge cluster is composed by:

- the main knowledge chunk;
- various support structures;

The figure 6 gives the steps of development for an eduknowledge cluster.

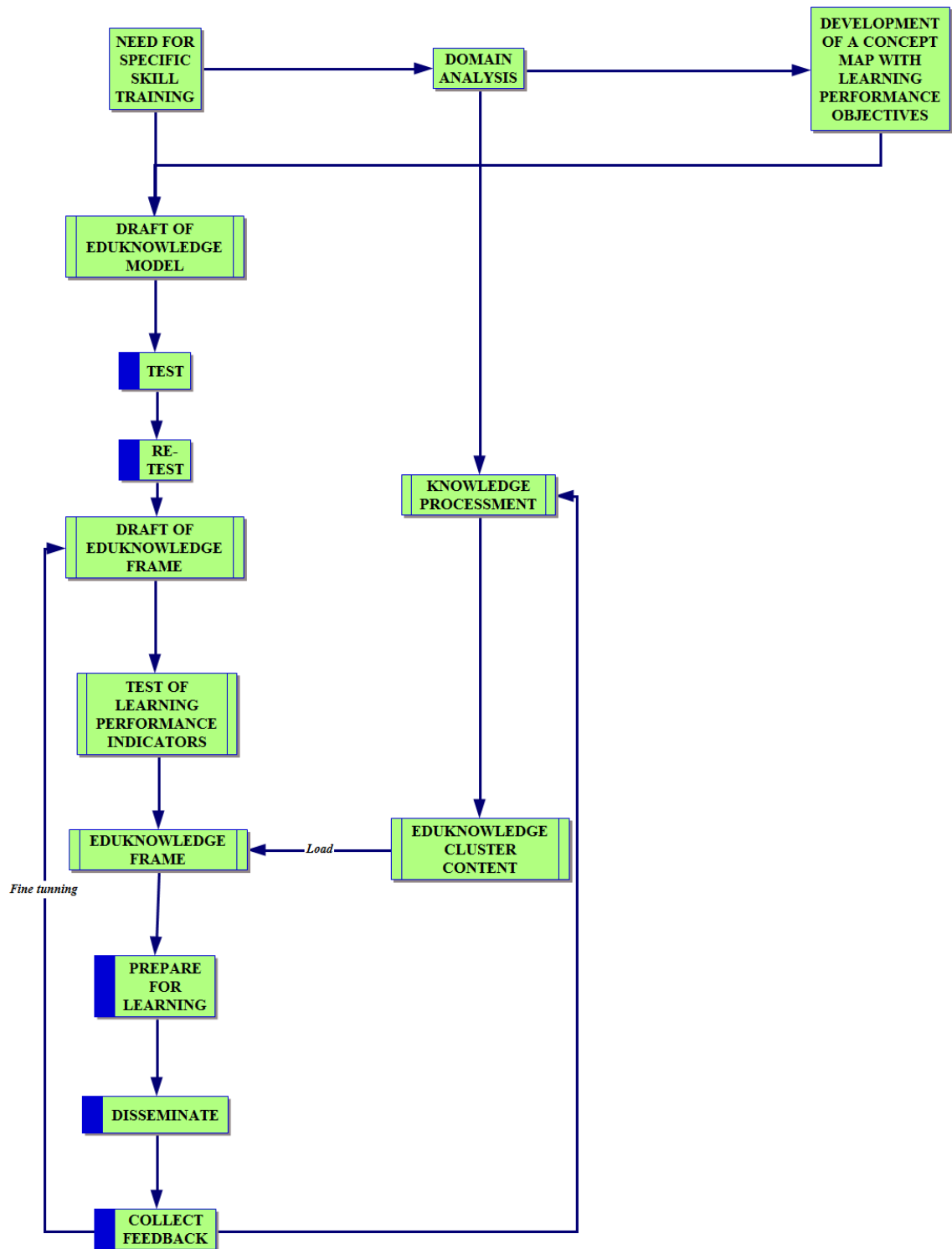


Figure 6. Steps in development of the eduknowledge cluster

2.3.1 Prototype Testing and Obtained Results

The developed prototype was conceived with the goal of mastering safety management for SME in the construction domain. Building is a very accident prone domain so the managers of building teams have a

special responsibility. In order to minimize the occupational accidents in the construction domain there was developed an eduknowledge cluster for safety management in constructions EC-SMC. A number of 5150 managers from all the construction SME in Romanian regions had performed a crash course using this eduknowledge cluster, on an Intranet network. Our test lot was composed mainly by men with an average age of 46 years and high school studies. We have focused on immediate feedback, with performance indicators like understandability, easiness in usage, perceived efficiency and a delayed feedback, asking for perceived efficiency after six months. All these parameters were assessed by the students on a 0 (inacceptable) 5 (excellent) scale. Using this scale we have received and processed 5000 feedbacks, finding that 76% of the responders have evaluated the easiness in usage and perceived efficiency at 4 or between 4 and 5, 14% at 5, 5% below 4 and 5% below 3. Understandability was evaluated by all the respondents at 5 - here however it is possible that the fear of not understanding some specific notions could have acted as a bias. Interesting is also that the immediate perceived efficiency was assessed - as a mean value - to 3.5. However, the delayed feedback has given a mean value of 4.4 this indicating, in our opinion, that the learning process using eduknowledge was more useful in reality than expected.

3. CONCLUSION

Eduknowledge as a design and content development tool has a lot of advantages. The main ones are summarized below:

- it allows the loading of any kind of content, making a distinct separation between the main knowledge body - which is reduced on a need to know basis (the user being able to further research if interested) and the dynamic parts of the e-learning

- it allows the easy processing of this content towards educational efficiency oriented clusters;

- it allows the easy elicitation of new knowledge specific of the domain;

- the efficiency of the individual e-learning process rises considerably. This rising is partially due to the individually tailored learning, partially to the clean-up of all the unnecessary knowledge and partially to the hands-on approach.

The eduknowledge framework is best fit for technical learning because:

- It involves a limited- and continuously changing- set of knowledge;

- Technical domains could be easily structured in such knowledge sets - being specific goal oriented;

- the set of knowledge has as the main goal the development of a specific skill or capability;

- the actual development of the skill or capability could be easily tested through grid tests and through a hands-on approach oriented towards a project development; the project being related to the usage of the new developed skills;

The main limitation of the eduknowledge tool is that it is very domain specific being conceived in order to develop a specific skill. A lot of work is involved in knowledge preparation; also, if the eduknowledge frame is not optimized the learning process could be not at the maximum efficiency.

ACKNOWLEDGEMENT

I want to thank my wife, for her precious support in the development of this paper.

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AUTOMATIC EVALUATION AND ASSESSMENT OF LOGISTICS COST ACCOUNTING EXERCISES

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ABSTRACT

Cost accounting is one of the major topics in business education. The specialized logistics cost accounting becomes more and more important due to the increasing relevance of logistic processes within enterprises. Therefore, this paper presents the concept and the implementation of an e-learning environment that concentrates on evaluation and self-assessment. It provides predefined or automatically generated exercises with which Students may practise where and whenever they like to via the Internet. Their solutions are marked automatically by the tool while considering consecutive faults and without any intervention of lecturers.

KEYWORDS

Automatic marking, e-learning environment, online practicing, randomly-generated exercises, evaluation, assessment.

1. MOTIVATION

Within university teaching, we can distinguish the following three key parts:

- Imparting knowledge to students (Teaching)
- Letting the students apply their new knowledge and deepening it (Practicing)
- Testing the students' knowledge and their comprehension (Assignment and Grading)

Concerning the teaching task, students mostly prefer traditional lectures, even if they are criticized for being antiquated, and they don't want them to be replaced by electronic lectures. Therefore, e-learning should not replace traditional lectures, but rather serve as an additional feature that assists traditional lectures with interactivity and multi-media elements.

With regard to the practising and assignment tasks, the student's individuality, by contrast, is on top. In order to do justice to that individuality, the teacher has to deal individually with each student and his or her abilities and deficits. Because of the uneven ratio between students and lecturers, such an occupation with individual abilities and solutions of students cannot be managed. A way out of this situation can be e-learning. E-learning allows us to provide exercises that are suitable to the individual situation and knowledge of each student, to mark the students' solutions automatically and to give individual hints concerning the lessons a student ought to revise again.

A suitable e-learning environment should be based upon the interactive and multi-media features of the Internet, which offer numerous possibilities for e-learning exercises and tools. Thus, students are able to practice whenever and wherever they wish. Such self-steered learning is one of the most efficient paths to comprehension.

One part of such an e-learning system should be that students can practise with sophisticated exercises in an interactive way, such that they have to find the answer on their own by using the learned approaches and their own knowledge. The exercises should not only be composed of simple forms like multiple choice, true-

false questions, jumbled sentences or fill-in-the-blank 0. In these cases, the practising students don't really need their knowledge because often they easily can guess the correct answers by systematically reducing the number of possible answers 0.

Didactically good exercises that really help students understand the contents of lectures should not contain the answer and the problem-solving process in a more or less apparent form. Students should rather be forced to prove their abilities to solve a problem. That can be done by not only evaluating the final result of an exercise, but also by considering the chosen way of problem-solving 0. In this context, it is important that students can choose their own problem-solving process without any restrictions. Restrictions should only appear if there are technical reasons 0.

Unfortunately, such interactive and sophisticated exercises either do not exist or are very rarely supported by e-learning systems because of their complexity 0. In most cases today, those exercises are still corrected by human beings 0, 0, 0.

But the disadvantages of traditional exercises are obvious: The manual marking of exercises absorbs resources and results in a time delay between practising, marking and feedback about mistakes and lessons to repeat although immediate feedback would be very valuable 0, 0. To remedy these problems, automatically marked exercises are needed 0, 0.

Due to the various degrees of freedom, this task is quite difficult to accomplish because often there is not only one correct answer, but rather several answers that are more or less correct. Thus, students' solutions cannot only be classified in the two categories right or wrong. We can instead identify a scale of correctness concerning the solutions because of consecutive faults and several more or less correct ways to solve the problem 0.

In the following, we will present an e-learning system that satisfies the requirements above. This e-learning system provides exercises for logistics cost accounting. It allows lecturers to manually predefine exercises as well as to generate them automatically. The system automatically marks the students' solutions without intervention of a lecturer. The marked exercises are presented to the students with hints about their deficits and lessons to be repeated.

2. APPLICATION

As traditional cost accounting mainly focuses on production, a source-related allocation of logistics costs to cost units cannot be achieved. The reason is that logistics costs are mostly overhead costs. Traditional cost accounting now argues, that those overhead costs suffer from a missing connection to products and therefore can only be allocated to cost units via value-based allocation measures like direct material costs, direct wages and production costs. Thus, the higher direct material costs, direct wages and production costs of a product are, the more this product is charged with logistics costs, neglecting the real use of logistics services. For example, within traditional cost accounting, a product that is composed of many low cost parts will hardly be charged with logistics costs, although it causes much more procurement costs than a product composed of only a few but expensive parts. The same situation holds for production logistics costs. Applying machine hours as allocation measures supposes a coherence between the production time of a product and its claim for production logistics services. But, rather, the complexity of the production processes is the appointing determinant. Finally, distribution logistics costs are not determined by production costs (as implicitly assumed by traditional cost accounting), but by a product's storage and transport attributes (e.g. dimension, weight etc.) 0. Taking into account that logistics costs make up 10-25% of industrial enterprises' total costs 0 or 5-10% of turnover 0, 0 and that logistics services have the utmost importance for differentiation in competition 0, these faults in cost allocation may lead to fatal errors in product-related decision-making due to wrong information concerning a product's logistics costs.

Another lack of traditional cost accounting can be seen in the fact that logistics costs are not reported separately in product costing, but as a part of procurement, production, sales and administration overhead costs (lack of transparency). For these reasons, basically two approaches have been developed or can be applied in order to achieve a source-related allocation of logistics costs to cost units:

- Weber proposes a refinement of traditional cost accounting 0. A similar approach is provided by Reichmann 0. Both approaches can be applied as absorption accounting or marginal costing.

- The second alternative consists of applying activity-based costing (ABC), which was explicitly developed for indirect service types and therefore can be assumed to be suitable for logistics cost accounting as well. But ABC originally was designed as full-absorption accounting [1, 2], which implies that it does not separate costs into its fixed and variable parts. Therefore, it is not able to provide any information with regard to short-term decision-making, such as accepting or refusing an additional order. Certain further developments in ABC try to remedy this deficiency by separating costs according to their dependency on the operating level and/or convertibility in time, in addition to the separation between costs for process-volume-induced and process-volume-neutral activities introduced by Horváth/Mayer [3] In this context, we especially have to mention the approaches by Reichmann/Fröhling [4], Glaser [5], Mayer [6] and Dierkes [7].

Although each approach is different from the others they have the following in common:

- In all of these approaches, logistics cost centers are defined as final cost centers.
- Except for the Reichmann approach, which only defines logistics specific surcharge rates, all approaches try to allocate logistics costs of cost centers to cost units via transfer rates that are based on volume-based allocation measures. This implies that we can clearly identify a relation between the output of logistics cost centers and the usage of this output by cost units. If not, we have to do without the allocation of the respective logistics costs or value-based surcharge rates have to be used as a remedy.

The fundamental difference between the approaches according to Reichmann and Weber on the one hand and the activity-based costing approaches on the other hand consists of the different number of calculation steps: Within the Reichmann and Weber approach, the costs of logistics cost centers are immediately allocated to the cost units via cost center-based allocation measures. By contrast, activity-based costing firstly allocates logistics costs to activities. In a second step, these activity costs are allocated to the cost units via activity-based allocation measures. Activities can be aggregated hierarchically over several levels. Commonly there are two hierarchy levels.

The further developments in activity-based costing mainly differ in the way of cost splitting. Cost splitting can refer to the costs' dependency on the operating level, which leads to the differentiation between variable and fixed costs, whereby fixed costs additionally can be differentiated according to the readiness to operate, and/or to the costs' convertibility in time (i.e. their commitment period), which leads to the differentiation between costs that are degradable in the short-, medium- and long-term.

2.1 Overview

Altogether, we can distinguish six different approaches of logistics cost accounting: The approaches according to Weber and Reichmann, the original form of activity-based costing developed by Horváth/Mayer and the further developments in ABC developed by Reichmann/Fröhling, Glaser, Mayer and Dierkes. An overview of the principles of each approach is given by [1] and [2].

In order to be able to compare the results of these six approaches to those of traditional cost accounting, the latter is also implemented in the e-learning system. This helps to demonstrate the mistakes of traditional cost accounting in allocating logistics costs to the products and therefore the need of a special logistics cost accounting system.

The major task of each logistics cost accounting systems consists of allocating a manufacturer's logistics costs properly (i.e. according to the products' claim of logistics services) to the cost units and in providing transparent information about the composition of these (product-related) logistics costs. Therefore, the subject of each exercise in logistics cost accounting is the calculation of product costs with special regard to logistics costs.

The relevant approaches and therefore the exercises that shall be implemented differ in

- the allocation measures used,
- the manner of cost splitting,
- the logistics cost categories (resulting from cost splitting) which are allocated to the product units and which are not and
- the applied calculation scheme.

All types of exercises have in common the master data concerning cost types, cost centers, allocation measures, activities (if needed) and the logistical attributes of the products to be calculated. These master data are independent of the chosen type of exercise and can easily be extended if necessary.

When practising, each type of exercise comprises the following three steps:

- Calculating cost type-based, cost center-based and/or activity-based allocation measures,
- Calculating the product-related values of the logistical allocation measures (i.e. the activity coefficients)
- Performing product costing by using the results of steps one and two.

Figure 1..□.□.□.□.□.□.□Z□□□□□□□□

Generation of Exercises

The e-learning system provides two different ways to generate exercises: They can either be created manually by lecturers, or they can be generated automatically by the e-learning system. When *manually* creating an exercise, we have to choose the exercise type (i.e. the logistics cost accounting approach to be applied), the mattering cost types, cost centers, allocation measures, activities (if needed) and the (logistical) attributes of the products to be calculated. (see fig. 1 left side) If the master data pool isn't sufficient, new master data can be added to the pool by lecturers. Based on the chosen master data, the e-learning system creates empty data sheets for the initial data that can be filled by lecturers with appropriate values. The calculation can either be done manually by the lecturer in order to test the exercise – the system then checks the solution and shows potentially made mistakes – or it can be performed automatically by the system. Finally, the lecturer can revise the exercise and make some changes before saving it.

Create a new Exercise Attributes Product 1	Exercise Results								
Number of units <input type="text"/> <input type="checkbox"/> Price per unit <input type="text"/>	<table border="1"> <tr><td>Direct material costs</td><td>50,00</td></tr> <tr><td>Purchase logistics overhead costs</td><td>24,70</td></tr> <tr><td>Other material overhead costs</td><td>10,10</td></tr> <tr><td>Total material costs</td><td>84,80</td></tr> </table>	Direct material costs	50,00	Purchase logistics overhead costs	24,70	Other material overhead costs	10,10	Total material costs	84,80
Direct material costs	50,00								
Purchase logistics overhead costs	24,70								
Other material overhead costs	10,10								
Total material costs	84,80								
Direct material costs <input type="text"/> Direct wages <input type="text"/> Special direct production costs <input type="text"/> Special direct sales costs <input type="text"/>	<table border="1"> <tr><td>Direct wages</td><td>60,00</td></tr> <tr><td>Manufacturing overhead costs</td><td>82,50</td></tr> <tr><td>Production logistics overhead costs</td><td>12,90</td></tr> <tr><td>Total manufacturing costs</td><td>155,40</td></tr> </table>	Direct wages	60,00	Manufacturing overhead costs	82,50	Production logistics overhead costs	12,90	Total manufacturing costs	155,40
Direct wages	60,00								
Manufacturing overhead costs	82,50								
Production logistics overhead costs	12,90								
Total manufacturing costs	155,40								
Number of parts per unit <input type="text"/> Number of operations per unit <input type="text"/> Volume (m3) <input type="text"/> Weight (kg) <input type="text"/> Average number of parts per pallet <input type="text"/> Average size of order <input type="text"/>	<table border="1"> <tr><td>Total production costs</td><td>240,20</td></tr> </table>	Total production costs	240,20						
Total production costs	240,20								
Machine hours production cost center 1 <input type="text"/> Machine hours production cost center 2 <input type="text"/> Machine hours production cost center 3 <input type="text"/>	<table border="1"> <tr><td>Administrative overhead costs</td><td>12,00</td></tr> <tr><td>Distribution logistics overhead costs</td><td>16,60</td></tr> <tr><td>Other selling overhead costs</td><td>22,20</td></tr> <tr><td>Total product costs</td><td>291</td></tr> </table>	Administrative overhead costs	12,00	Distribution logistics overhead costs	16,60	Other selling overhead costs	22,20	Total product costs	291
Administrative overhead costs	12,00								
Distribution logistics overhead costs	16,60								
Other selling overhead costs	22,20								
Total product costs	291								
<input type="button" value=" < Back"/> <input type="button" value=" Forward >"/>	<div> <div>Wrong value </div> <div>Consecutive fault</div> <div>Consecutive fault</div> <div>Consecutive fault</div> </div> <div> <input type="button" value=" < Back"/> <input type="button" value=" Forward >"/> </div>								

Figure 1. User interface

When *automatically* generating an exercise, there are several interdependencies between the different data of exercises that have to be considered. For example, a realistic ratio between staff costs and material ex-

penses, variable and fixed costs, direct and overhead costs should be guaranteed as well as a realistic level of the transfer and surcharge rates. These interdependencies are stored as rules in a rule database and are used each time an exercise is generated. The e-learning system randomly generates the basic data and then adjusts these data by using the rules. The dependent and derived values are computed.

2.3 Difficulty Levels

In order to achieve a broad acceptance of e-learning, exercises should be suited to the actual knowledge of students 0. For this reason, different difficulty levels should be offered. The possibility of choosing different underlying approaches leads to different difficulty levels and handling times, yet. Additional difficulty factors are the number of cost centers, activities, activity types (e.g. output-based and non-output-based ones), the kind of cost splitting etc. These elements are parameterised and build the fundamentals in computing difficulty level and target time of an exercise.

The number of cost centers or activities, for example, affects the number of calculation steps and therefore must have an impact on the target time. By contrast, the content-oriented difficulty level is influenced by the kind of cost splitting or the number of different activity types occurring in the exercise. Thus, the target time is computed with the number of calculation steps, and the difficulty level is computed with the help of the different difficulty parameters.

When automatically generating an exercise, the components of an exercise are chosen with respect to the given difficulty level. The target time is then also influenced by the chosen components: Complex components lead to longer target time, easy components can be handled faster.

Another variation of difficulty can be derived from the different conditions that may hold at the beginning of an exercise. At easy levels the whole calculation scheme can be provided to users. In this case, students only need to compute the correct values. At top levels, no presettings are made and students will have to design the problem solution process, as well as to compute the correct values.

2.4 Practising with Exercises

Normally, no presettings are made to students. Necessary variables have to be defined by students themselves. Therefore, variables can be created by defining two inputs: The name of the variable and the values. The name of the variable can either be chosen out of a list of possible names or it can be defined in a free text field. In order to recognise free user inputs, a fault-tolerant word recognition function, based upon well known metrics like the Levenshtein or the Damerau distance, is implemented. With the help of these metrics, the correct variable name can be identified out of the user's input.

In exam mode, an exercise has to be solved within the target time. When the target time expires, the solution is sent to the e-learning system and is automatically marked. Beyond the exam mode, a message that the normal target time has expired is displayed. After finishing, the total time of practising is compared to the target time and a grading is presented to the user.

2.5 Automatic Marking

Each type of exercise is based upon a more or less simple form of calculation that can be modelled by calculation rules 0.

Because of the free user input and the various possibilities to solve the problem provided by an exercise, a simple marking by comparing the results of the students' calculations with the reference solution won't succeed. Rather, we have to follow the students' solution processes in order to understand how they have reached their results. Therefore, we firstly recognise the used variables of the students' solutions. After that the calculation is reconstructed by using the rule database. Doing so, three kinds of faults can occur:

- 1) Necessary variables are missing.
- 2) Values of variables are faulty.
- 3) Needless variables are used.

If values are faulty the system marks the mistakes and inserts a hint. At first sight, the usage of needless variables is not critical. But it may happen that those needless variables aren't needless: They might be missing variables that haven't been recognised correctly. In order to avoid this marking mistake, not only the

names but also the values of the variables are used while recognising the variables. If a variable is missing, a percentage is subtracted from the total achievable score and the fault is marked. If there are further calculation steps, the marking algorithm proceeds despite missing or faulty variables. Doing so, we have to care about consecutive faults that result from missing or faulty values.

In order to recognise these consecutive faults, the marking procedure uses the already marked values and recalculates the following calculation steps with these faulty values. Thus, correct calculations are recognised as correct with respect to faulty values. Consecutive faults are also marked, but they don't lead to a reduction in scoring. The right side of figure 1 shows the user interface for students after the marking process. All faulty values and all consecutive faults are marked. The marking »Wrong value« indicates that the student has calculated a faulty value. Therefore, a hyperlink is built that leads to a special hint where the student can read everything about the concerned topic, in this case »Production logistics overhead costs«. By clicking on the lens, the student can track his mistake in his previous calculation steps.

3. SYSTEM ARCHITECTURE

The following objectives were the major focus during the design of the e-learning system:

- Provision of predefined exercises
- Provision of randomly generated exercises
- Automatic marking of students' solutions
- Provision of an exam mode

In order to put these objectives into practise, the system requires an exercise administration module, a user administration module, an exercise generation module, a master database and a rule database, a configuration module, a content module and a representation module (see fig. 2).

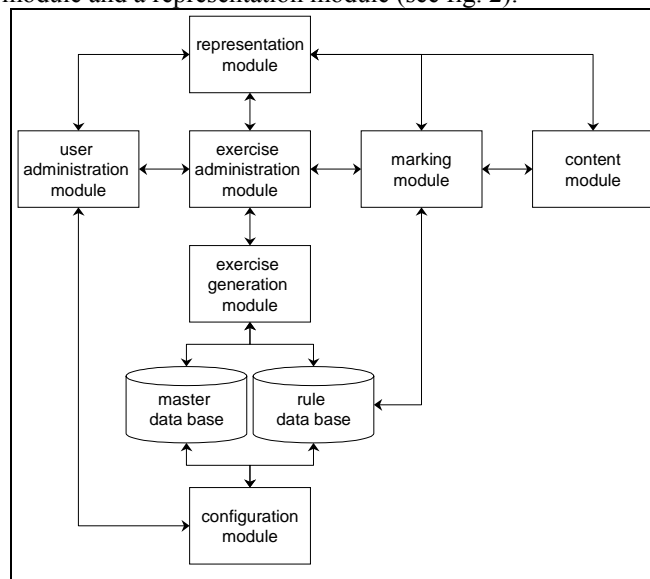


Figure 2. Architecture of the e-learning system

The *exercise administration module* stores and manages the exercises predefined by lecturers as well as the automatically generated ones. All exercises are classified according to their difficulty level. The difficulty level results from the different accounting methods and the calculation components which occur in an exercise. The *user administration module* manages every single user. Every user can act in different roles: Students can practice with exercises, automatically generate exercises and have a look at the marking of their solutions. Lecturers can predefine exercises or automatically generate them, work on exercises like students and have a look at students' solutions to gain an insight into student's knowledge. Administrators assign roles

to each user, work on fundamental system parameters and adjust the parameterisation of the difficulty levels. The solutions of users are also stored in the user administration module.

The *exercise generation module* can be used by students and lecturers. Students can choose a difficulty level and choose whether they want to work on that exercise in the exam modus or not. Lecturers as well can automatically generate exercises and select a difficulty level. Additionally, they can in- or exclude single parameters to create a more specialised exercise. The generation module provides an exercise according to the chosen preferences and calculates the target time for solving with regard to the difficulty parameters. The exercise is generated with respect to the master data stored in the *master database* and to the rules stored in the *rule database*. The lecturers are able to add master data and rules to these databases via the *configuration module*.

After the expiration of the target time (if the exam modus was chosen) or after the exercise has been finished by the student, the solution is sent to the *marking module*. This module evaluates the solution using the rule database, marks right and wrong elements and gives hints as to which lessons should be repeated via the *content module*. The exercise is represented via the *representation module*.

The presented e-learning system is a client-server-based system, developed with classical web technologies. Work on exercises and therefore exercise representation takes place at the client. The frontends of the administrative modules also run at the client side. All other modules are only operated on the server side.

4. CONCLUSION

In this paper we presented an e-learning system that generates and provides exercises concerning logistics cost accounting. As there are several approaches that can and have to be taken into consideration, logistics cost accounting offers various possibilities of practicing. The benefit of the system consists of the following advantages:

- Students can practise whenever and wherever they wish.
- Students get feedback in a predictable time due to automatic marking.
- Exercises are suitable to the students' actual individual knowledge.
- Innumerable exercises can be created automatically.
- Lecturers are relieved of routine jobs.

The system is now ready to use. Future work will focus on generalizing the system to an e-learning system for all types of cost accounting.

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E-READINESS ASSESSMENT MODEL FOR B2C PUBLISHING COMPANIES TOWARD E-PUBLISHING

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ABSTRACT

During recent years Information Technology has made several fundamental changes in different business areas. For instance, publishing industry is experiencing a dramatic change affecting on the whole society which would be as great as that of the development of printing press. It has revolutionized the publishing industry and given rise to a new phenomenon called electronic publishing (e-publishing). E-publishing aims at generating, maintaining, keeping, and diffusing electronic data using computers and information networks. It provides the developing countries with appropriate opportunities for development and progress. These countries should reap the benefits of e-publishing and have access to necessary technology.

E-readiness assessments are meant to guide development efforts by providing some suitable tools for comparison and gauging progress. Several e-readiness assessment tools have been created and used by different groups. But so far, critical issues for e-readiness assessment for publishing companies have not been systematically investigated. Some existing studies have derived their critical factors from macro perspectives at country level and have not considered the important factors at micro level for SMEs in an integrated way.

This research is probably the first to support a perspective of critical issues for e-readiness assessment in publishing companies based on macro models. It will give a good insight which expectantly could be helpful for managers to consider the critical issues for e-readiness assessment of their organization in an effective way. Therefore, we will review the e-readiness assessment models proposed for organizations at macro scale and then identify the critical factors for e-readiness assessment of publishing companies. The extracted factors are Technical Infrastructure, Economical and Financial issues, Social, Management, and Human Resources which are achieved through exploratory and confirmatory factor analysis at the micro perspective of some of the Iranian e-publishers.

KEYWORDS

E-Readiness, B2C, E-Publishing, Confirmatory factor Analysis, Publishing Companies

1. INTRODUCTION

The Knowledge Economy (KE) is emerging from two defining forces: the rise in knowledge intensity of economic activities, and the increasing globalization of economic affairs. The rise in knowledge intensity is being driven by the combined forces of the information technology revolution and the increasing pace of technological change (Beig et al., 2006). With the current trend toward globalization of e-business, e-readiness assessments are becoming of increasing importance for diagnosing problems, and directing future development efforts (Bakry, 2006). If any country wants to gain the benefits offered by IT, It has to implement technology and use it effectively across society and the economy. Moreover, countries face the threat of being left behind if they do not address the growing digital divides both between and within countries (Beig et al., 2006). An e-readiness process based on an objective assessment that leads to sound e-strategies can offer a path for converting good intentions into planned action that brings real changes to people's lives (bridge.org, 2005). The main problem with e-readiness assessments is the lack of a common standard

assessment policy that would provide unified assessment measures, support relative analysis and comparisons, and help in diagnosing problems and driving solutions (Bakry,2003).The main objective of this article is to present an e-publishing assessment tool that could cover all aspects of e-readiness assessment tools. So, in section2, we will define e-publishing and its advantages over traditional one. Next, the e-readiness definition, background and its importance will be reviewed. After that some of e-readiness tools will be illustrated. Moreover in Section 3, the critical factors for e-readiness assessment will be extracted and validated by two accurate statistical techniques which are Factor and confirmatory factor analysis. Finally, there is a conclusion section summing up the results obtained in this research.

2. E-PUBLISHING

Electronic publishing (e-publishing) is the process of creating and disseminating information via electronic means including email and via the Web. Electronically published materials may originate as traditional paper publishing or may be created specifically for electronic transfer (about.com,2003;cited by Kozak,2003).Also Aluri(1996) defines electronic publishing as the dissemination of information in electronic form and its distribution to potential users either on electronic networks such as Internet and local area networks or in stand-alone formats such as CD-ROMs. The information so distributed is intended for the user to read, print, and download for later use, within the limits imposed by copyright laws, including incorporation of selected information into other electronic documents. Electronic publishing products may include text, graphics, audio, video, numeric and textual databases; reference sources such as directories and atlases; and computer programs. The greatest benefit of electronic publishing is the richness of information that is available to the end-user (Aluri, 1996). Publishers embraced electronic publishing technology in recent years because it speeds up the publishing process, makes editorial changes easier to accomplish, and enables the relatively small publishers to effectively participate in publishing activities. Electronic publishing has opened up new markets such as publication of encyclopedias in CD-ROM format, creation and distribution of electronic databases of indexing and abstracting services, and electronic journals. In fact, since most of the publishers are now requiring their authors to send in their manuscripts in electronic format, it is relatively simple to load them on computers and make them available to readers and libraries (Aluri, 1996).It allows faster dissemination of information than print technology because the step of printing is eliminated. Recent empirical evidences from several countries show a strong tendency toward IT investment in general and e-publishing in special. However, most publishers in Iran still use their traditional business strategies and resist to any changes. Today's global changes dictate a new model of thinking as a basic requirement. The publishers in Iran have to reorganize their insight toward digital publishing which is currently more based on their traditional view concern to texts which they think it should be tactile. As e-publishing is in its infancy in Iran, it is necessary to begin the introduction of ICTs in micro and macro levels to bring and ease the related changes of Iranian publishers. The first step is assumed to be an e-readiness assessment. E-readiness of publishers is defined in this paper as the ability of publishers to successfully adopt, uses, and reap the benefits of the current Information Technology's stratagem. In the following, we describe the e-readiness concept and various e-readiness tools in depth.

3. E-READINESS

E-readiness is a relatively new concept that has been given impetus by the rapid rate of Internet penetration throughout the world, and the dramatic advances in uses of information technology (IT) in business and industry (Choucri et al., 2003). Countries are striving to become inclusive global knowledge societies where all persons without distinction are empowered to create ,receive, share and utilize information and knowledge for their economic, social, cultural and political development (Consulting and Audit Canada,2004) and spans a wide range of factors, from telephone penetration to online security to intellectual property protection (EIU,2002).The e-readiness concept was originated by the intent to provide a unified framework to evaluate the breadth and depth of the digital divide between more and less developed or developing countries during the later part of 1990s (M. Mutulaa and van Brakel,2006).The first efforts in defining e-readiness were undertaken in 1998 by the Computer Systems Policy Project (CSPP) when it developed the first e-readiness

assessment tool known as Readiness Guide for Living in the Networked World .CSPP defined e-readiness with respect to a community that had high-speed access in a competitive market; with constant access and application of ICTs in schools, government offices, businesses, healthcare facilities and homes; user privacy and online security; and government policies which are favorable to promoting connectedness and use of the network(Bridges.org, 2001).The Centre for International Development at Harvard through its macro readiness for the Networked World tool (CID)defines e-readiness in relation to a society that has: the necessary physical infrastructure(high bandwidth, reliability, and affordable prices);integrated ICTs throughout business, communities, and government and universal access (Bridges.org,2001) .High level of e-readiness allows enterprises to transact business electronically in order to achieve less turn-around time, faster delivery of services, enhanced product selection, international competitiveness, a broader market reach, increased convenience for customers, reduced procurements costs, decreased average transaction costs, enhanced profitability, faster and limitless access to new customers and suppliers, exchange of information, and enhanced open standards allowing start-ups of small companies . Since the development of the first e-readiness tool several e-readiness tools have emerged through efforts of development agencies, research organizations, academia, business enterprises and individuals (M. Mutulaa and van Brakel, 2006). Despite the variations in the definitions of e-readiness by different tools, there are a lot of resemblances among tools and each tool defines indicators in their own word but with the same function .Moreover, they on average, measure the level of infrastructure development; connectivity; Internet access; applications and services; network speed; quality of network access; ICT policy; ICT training programs; human resources; computer literacy; and relevant content. As illustrated in Table 1 some of these tools are abridged. The outstanding issue with e-readiness assessments is the lack of a common standard assessment policy which would provide integrated assessment measures, support relative analysis and comparisons, and help identifying problems and deriving solutions. Most of aforementioned tools focus on infrastructures but don't pay attention to on some main constructs such as social or policy aspects. Since there is no special tool to suffice all dimensions of e-readiness, the main objective of this paper is to provide a model which could cover all the domains of e-readiness in the B2C publishing companies.

Table1. E-readiness Assessment Tools

Tool Name	Source	Focus
APEC	The Asian Pacific Economic Cooperation (APEC) Electronic Commerce Steering Group	Assess a country's preparedness for e-commerce
EIU	The Economist Intelligent Unit	e-business and commerce readiness
McConnel	McConnell International prepared this report in collaboration with WITSA	human capital, information security, Infrastructure, e-economy , education, and government
Mosaic	Princeton University	Asses the current level of technology
WITSA	World Computing Service Industry is a consortium of 38 IT industry associations from economies around the world	Experiences of companies with ecommerce and their views of promoting e-commerce
CSPP	Computer systems Policy project	Technology usage
CIDCM	Center for International Development and Conflict Management (CIDCM) at Maryland University	Diffusion of ICT's in developing countries
CID	Center for International Development at Harvard University	Understanding of technology's pivotal role in Economic development and exploit the opportunities offered by ICTs
KAM	the World Bank's Knowledge Assessment Methodology	Knowledge economy

Before making a suitable model we need to make two hypotheses: H1. There are not any suitable e-publishing readiness tools, H2. We could make a suitable model based on prior tools. Based on hypotheses and regarding the fact that there are not any suitable e-publishing readiness tools, we try to extract critical factors of e-publishing readiness of publishers regarding the e-readiness assessment model at macro level. The important areas for e-readiness assessment at macro which we use in our research are depicted in Table 2. As it is seen in Table 2 most of the indicators are common among the E-readiness tools. Also there are some important variables like “Ease of registering a new business” or “Domestic credit to Private sector” that are focused by a small number of tools which shows the criteria of these tools. Like EIU that focuses more on e-business criteria.

Table 2. Critical areas of e-readiness assessment at macro level

Criterion	E-readiness Assessment tools
Infrastructure	APEC, EIU, McConnell, GDI, WITSA, UNCTAD, CID, KAM, NRI, WTI
Pricing	APEC, McConnell, WITSA, UNCTAD, CID, NRI, WTI
Reliability	APEC, EIU, WITSA, CID
Service and support	APEC, EIU, WITSA, CID
E-commerce	APEC, EIU, McConnell, GDI, WITSA, UNCTAD, CID, NRI, CSPP
Market competition	APEC, EIU, McConnell, GDI, WITSA, UNCTAD, KAM, NRI, WTI
Export trade, Foreign Investment	APEC, EIU, McConnell, GDI, KAM
Use of Internet in business	APEC, EIU, McConnell, GDI, WITSA, CID
Ease of registering a new business	EIU
Regulation (Privacy, e-signature, etc.)	EIU, GDI, WITSA, CID, McConnell, APEC, KAM, WTI
Government spend on ICT	EIU, CID, KAM, NRI
Basic Legal framework	APEC, EIU, McConnell, GDI, WITSA, CID, KAM, NRI
Tax regime, Tariff and Non Tariff barrier	APEC, EIU, WITSA, KAM, NRI, WTI
Domestic credit to Private sector	GDI, KAM
Technical skills of workforce	APEC, McConnell, GDI, CID, KAM, Orbicom, NRI
Availability of Trained workforce	EIU, McConnell, APEC, WITSA, CID, KAM, Orbicom, NRI
Content related training of educators	McConnell, KAM
Level of education	EIU, GDI, KAM, CID, NRI
Public expenditure on education	KAM, NRI, CID, McConnell
Adult literacy rate	UNCTAD, KAM, NRI, WTI, Orbicom
Use of ICT in Everyday life	EIU, GDI, ORBICOM, CID, McConnell, APEC, KAM, WTI, EIU
Utilization of Technology	McConnell, GDI, UNCTAD, CID, KAM, Orbicom, NRI, WTI
Household online	CID, APEC, CSPP, McConnell, NRI
Consumer Trust	WITSA, UNCTAD, CID, NRI
ICT management and policy	CID, CSPP, EIU, CIDCM

4. RESEARCH METHODOLOGY

This study utilized a 5-point Likert-type scale (Likert, 1974) for measuring variables. To summarize data and develop constructs, we used the factor analysis technique and to confirm the model the confirmatory factor analysis is employed. Exploratory Factor analysis provides direct insight into the interrelationships between variables or respondents and empirical support for addressing conceptual issues relating to the underlying

structure of the data (Akhavan et al., 2008). It also plays an important complementary role with other multivariate techniques through both data summarization and data reduction. From the data summarization perspective, factor analysis provides the researcher with a clear understanding of which variables may act together and how many variables may actually be expected to have impacts in the analysis. In this research the factor analysis method applied in this research is Principle Component Analysis (PCA) developed by Hotelling (1935) and the condition for selecting factors was based on the principle proposed by Kaiser (1958) in which: Eigenvalues should be larger than 1, and an absolute value of factor loading greater than 0.5. Confirmatory factor analysis is often used in data analysis to examine the expected causal connections between variables (Hurley et al., 1997). CFA inspects the relationship between indicators and their latent variables. In this way a questionnaire was designed based on the factor analysis whilst incorporating the important areas of e-readiness assessment with 66 questions measuring attitude. Designing the questionnaire, we send it to three experts with academic backgrounds in designing questionnaires to modify whether there is any vague or undefined point.

4.1 Data Collection

Modifying the questionnaire by experts, to get the most important indicators related to the e-publishing readiness, we needed to interview with the ones whose experiences were straightly related to the e-publishing and had done some works in this area. So to extract the factors related to e-readiness of publishing companies, the research focused on e-publishing companies and also some related experts in Iran, specializing and working in an ICT domain including hardware and software, ICT consulting and ICT services. It is tried to concentrate on companies which are familiar with “e” activities and are seen as pioneers in this field in Iran. In order to understand the viewpoints on e-publishing readiness from all sectors of these organizations, questionnaires were sent to information, finance, research and development, academic and human resource departments of these organizations. The main sampling targets were senior managers, department managers and personnel who were involved in decision-making. By and large, 102 questionnaires were sent out and at last 80 questionnaires returned showing a 78.4% return rate.

4.2 Reliability

Wortzel (1979) argued that the result is highly reliable if the Cronbach's α value is between 0.70 and 0.98 and it should be ignored if the Cronbach's α value is below 0.35. In sum, the Cronbach's alpha for all the factors were above 0.8. The Cronbach's alpha calculated from the 66 variables of this research was 0.94, which shows high reliability for designed scale. In order to determine whether the partial correlation of the variables was small, the authors used the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy (Kaiser, 1958). The result shows that all of the KMOs for the variables were above 0.8 which is meritorious.

4.3. Result

Based on item content, factor loadings and modification Indices, three items from logistical and policies were discarded. This leads to a 63-factor model, providing a good fit with the data. To identify the underlying structure of the activity items, we conducted a Confirmatory Factor Analysis in LISREL 8.5 (Jöreskog & Sörbom, 2001) in an exploratory way. Based on item content, factor loadings and modification Indices, three items from logistical and policies were discarded. This leads to a 63-factor model, providing a good fit with the data. Based on the recommendations of Bentler and Hu (1995), model fit was evaluated in terms of multiple fit indices, including chi-square, the root mean square error of approximation (RMSEA), the standardized root mean square residual (SRMR), the Non-Normed fit index (NNFI) and the goodness of fit index (GFI). For the RMSEA, values between 0.05 and 0.08 as acceptable, and values (Browne and Cudeck, 1992). The goodness of fit index (GFI) should be above 0.90 (Bentler, 1992). The indices show that the 63 – factor model, which is shown in Figure1, is the best fitting model. It presents the χ^2 (Chi-Square), degrees of freedom (df), Adjusted goodness of fit index (AGFI), GFI, SRMR and RMSEA for new model. Based on the value of each index we conclude that our model is the best fitting one. It is tried to identify and label the confirmed factors based on the principle of being concise without losing clarity of meaning. When a factor

solution has been obtained in which all variables have a significant loading, it is tried to assign some meaning to the pattern of factor loading.

Table 3. Measure of model fitness

Index	χ^2/df	NNFI	GFI	AGFI	SRMR	RMSEA
Admissibility	≤ 3.0	≥ 0.9	≥ 0.9	≥ 0.88	≤ 0.1	≤ 0.08
Results	1.716	0.94	0.94	0.86	0.05	0.079

In this manner, it is tried to allot a name or label to an indicator that accurately reflects the variable loading on the factor (Hair et al., 1998). Analyzing the constructs and their related factors, the results shown below are detected:

- In the Technical Infrastructure criterion the communication infrastructures is the most important critical factor among the others. Also speed and quality, number of computers, suitable hard and soft wares, and using Wi-Fi are the most important indicators for the infrastructure.
- In the Economical and Financial criterion the financial support has the significant role; furthermore, stipend of computer technician and expenditure of registering and disseminating of e-books information in the web, are consequential factors which needed to be concentrated.
- In the Legislation and Policies criterion two factors have weighty position in this criterion called financial persuasive policy and administrative law. Also for the factor of financial persuasive policies, increasing budget of e-publishing and existence of suitable policy in disseminating diffusion of e-books have noteworthy duty on financial policy. Moreover, for the administrative law factor, legal mechanism of e-books pricing have significant role.
- In the Social criterion trust is a critical factor. It consists of three indicators that are house hold online, liability, standards which have meaningful roles.
- In the Human Resource criterion the factor of acceptance level has an essential duty. Also number of secondary or tertiary educated employees and description of the role and responsibility of personnel have notable place in the acceptance level factor.
- In the Management criterion the factor of administrative tasks has significant role, Moreover; quality of services to expand IT and level of enthusiasm of publishing companies toward expanding e-publishing have facund role.

Based on what mentioned up to now, a model can be conceptualized according to the findings of the research, which shows the critical issues of e-readiness assessment (Fig 1). This new model is based on data analysis of this research and provides a micro model for e-readiness assessment of publishing companies through the factors of e-readiness at macro level. According to the study findings, the critical issues for assessment of publishers in Iran were extracted, based on selected e-readiness assessment models in national level like APEC, KAM, EIU, CID and have been affirmed for micro level (publishing companies).

5. DISCUSSION AND CONCLUSION

This research has several policy implications:

Firstly, as shown in Figure 1, although the management factor could explain just 20% percent of e-publishing ($R^2=0.45^2$), it is the most critical factor among the others. Managerial issues such as level of investment, enthusiasm toward expanding e-publishing, perception of CEOs on opportunities and threats of IT are important indicators needed to be more focused. Moreover, ICT management is a key issue for competitive advantage and further growth.

Secondly, the human resource factor explains just 18% percent of e-publishing ($R^2=0.43^2$) indicated that it needed to be more focused; Also, the acceptance level and qualified workers as its critical factors should be concentrated. Moreover, recruitment of innovative and creative scholars has to be focused.

Thirdly, the social factor states only 25% of e-publishing ($R^2=0.48^2$); however, cultural and emotional issues and trust as human resource factors are emphasized by experts. Moreover, the “industry standards” criterion plays a significant role in this set since it is related to trust and assurance. Also, Internet literacy and

perception of people toward e-texts are also critical issues which could not be ignored. In this way, in order to be succeeded, the culture and beliefs toward e-text needed to be altered first.

An interesting point in this research is that technical infrastructure is not distinguished as an important factor ($R^2=0.20^2$). It took the lowest percentage of describing e-publishing which showed that managerial, cultural factors and human resource issues are more important than the other factors for success in e-publishing. But this industry needs greater infrastructural support in order to reap the benefits of ICT and to develop the capabilities to contribute in the economic development.

Furthermore, the legislation and economical issues are not stated as important factors in regard to managerial issues which showed that government policies could not be effective in this industry. Also to enter into e-publishing, the expenses are not so high that makes it a good opportunity for most people to get involved in with making huge investments.

In sum, what we have done in this paper is the extraction of the critical aspects of e-readiness assessment of B2C organizations in general and e-publishers in special in Iran. In this regard, we have reviewed the important areas of different countries e-readiness assessment according to some established models (macro level). Afterwards, we designed a research protocol for e-publishers, including 66 questions based on the important areas of e-readiness assessment for macro level. In the other words, we presented a questionnaire that asked the experts about e-readiness assessment factors in e-publishing with relation to the important aspects of e-readiness assessment for macro level.

The authors applied exploratory and confirmatory factor analysis in this study. Six important constructs which represent the critical issues for e-Publishing assessment were extracted. This study is probably the first one providing a perspective of critical issues for e-readiness assessment in e-publishing based on macro models in a developing country. It gives valuable information and guidelines which hopefully will help the publishers in special and B2C organizations in general to consider the critical issues of e-readiness assessment through their organizations in an effective manner.

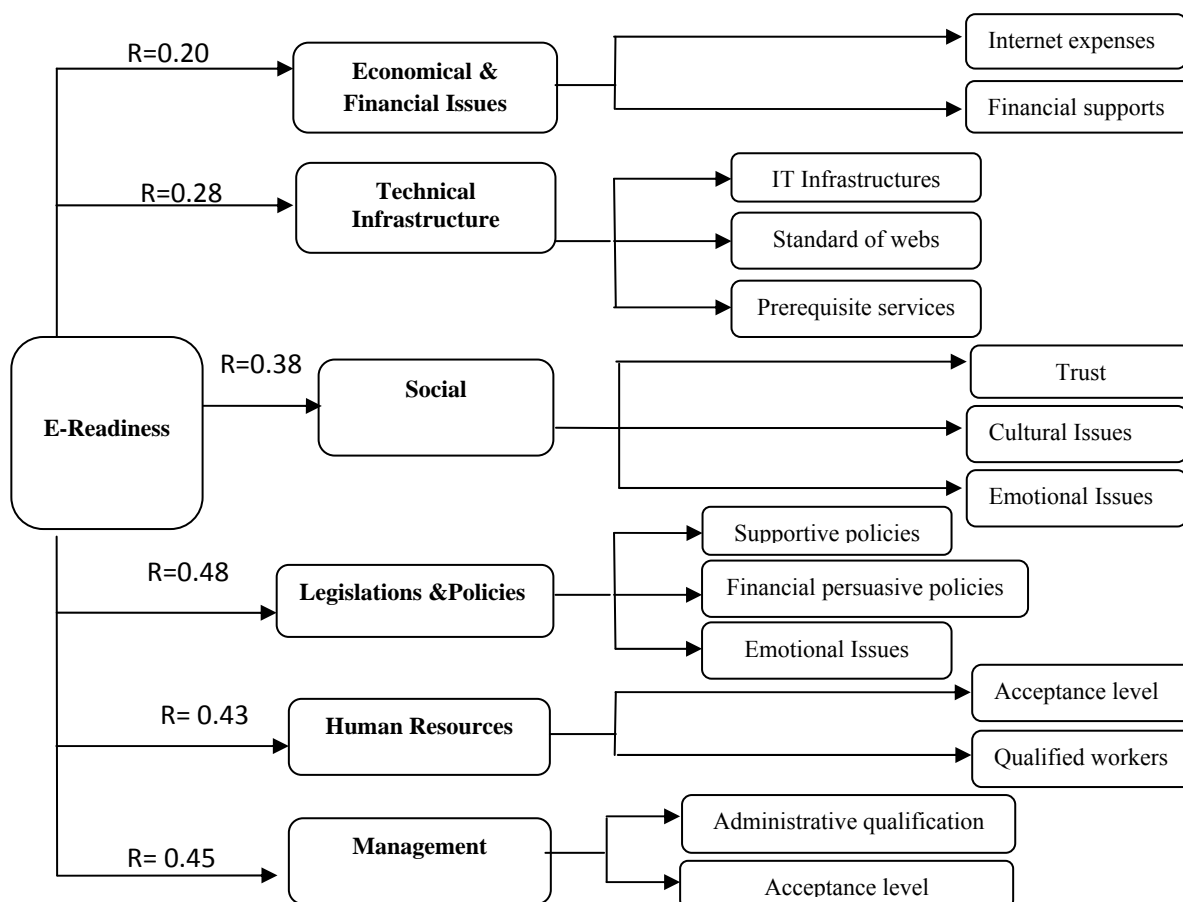


Figure 1. E-readiness model for assessment of B2C Publishing companies (based on research results)

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ABSTRACT MODELS OF HCI: EXTENDED RED – PiE MODEL

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ABSTRACT

Many computer users have trouble learning and remembering information presented on a computer screen. Based on cognitive theories, part of the reason for lack of retention is hypothesized to be the user's inability to form a mental picture, or schema, of the information presented via a computer screen. This paper deals with mathematical model of HCI (Human Computer Interaction) when applied in domain of interactive systems design and investigates level of abstraction suitability. Previously introduced RED – PiE model is extended with some cognitive functions which results in newly proposed RECgD – PiE model. This model is suitable for HCI design in the domain of educational software and e-learning. One experimental application of RECgD – PiE model, given in this work, shows how this kind of HCI can contribute to general representation and usability of user interface.

KEYWORDS

e-Learning, Human-computer interaction, RED-PiE model, educational software

1. INTRODUCTION

Last decade has been full of technology and methods development in domain of human machine interaction (HMI). This development has enabled, in both technological and methodological way, system development which can meet the users' needs. Greater expectations and increasing users' needs and also development of interactive methods and technologies can redefine HMI domain. The main goal of these systems is making environments which can interact not only with cognitive and psychomotor sphere of a user, but also with affective, social and emotional sphere. The development of these systems could not be possible without new methods, technologies and technical solutions in domain of computer science. HCI - deals with Human Computer Interaction. The domain of HCI includes not only the user, it has two-way interaction (computer system can also be user).

This development focuses on users, their common characteristics, reactions and needs. Users do not have to adapt themselves to designer's needs. The process of adaptation has gradually been shifted from user to computer. The user is more than ever the central part of system design.

Some researches do not discuss users and machines as separate entities; they discuss systems which cooperate mutually, integrated human-machine systems and united cognitive systems (Hollnagel, 2003). These connections reflect deep and important changes in the philosophy of design and our expectations from computer systems.

There are still frustrating applications and systems in which good intention can not always guarantee good results (Hoffman et al., 2002). However, these systems cannot survive in competitive and user- based environment.

As the range of computer applications becomes wider and as we are closer to expected computer environment, new demands influence on human-machine interface (Lyytinen and Yoo, 2002). These demands arise not only due to different tasks, but also due to increasing user population and decreasing tolerance of users' frustrations.

Finally, synergies of technological and methodical advance on one hand, and different users' expectations on the other hand, have redefined demands constituting successful and desirable HI. The key component of

these demands and successful human-computer interaction is, generally, the ability of these systems to influence user (user affect).

Many computer users have trouble learning and remembering information presented on a computer screen. Based on cognitive theories, part of the reason for lack of retention is hypothesized to be the user's inability to form a mental picture, or schema, of the information presented via a computer screen (Chalmers, 2003). In order to make this schema, the user should be able to put new knowledge in the frame of previous one. The problem is finding wide context of knowledge which can provide putting new knowledge in consistent and sensible way. Good example is using Web sites. After a while i.e. after visiting a certain number of Web pages, the user could ask himself what kind of knowledge has been presented to him, is it in relation with his intentions and which wider frame does it fit in. This user disorientation can be very important subject of research on order to create HCI system which can overcome this problem and improve user's satisfaction with using these systems.

Human-machine interaction (in this case computer) has been accomplished through appropriate interface. Human-computer interface is defined as "contact point between application and end user" (Sheppard & Rouff 1994, page 1402). In the domain of educational software, human-computer interface enables student (end user) to communicate with a computer and computer to communicate with a student. This interaction has been achieved through hardware components of the system such as: keyboard, mouse, touch screen, light pen, etc. The very important part of this interaction is software including screen displays design (icons, menus, dialog boxes, graphic elements, etc.)

2. COGNITIVE SOFTWARE DIMENSION

The synergy of technological and methodological progress on the one hand, and changing user expectations on the other, are contributing to a redefining of the requirements for what constitutes effective and desirable HCI. A key component of these emerging requirements, and of effective HCI in general, is the ability of these emerging systems to address user affect. Why the vague term 'address'? Because 'addressing affect' encompasses various interpretations, corresponding to the variety of possible roles and functions that affective considerations introduce into HCI. It can mean recognizing user affect, adapting to the user's affective state, generating 'affective' behavior by the machine, modeling user's affective states, or generating affective states within an agent's cognitive architecture. Figure 1. highlights these roles and functions in the context of a human-machine collaborative system, and the remainder of this section describes them in more detail below (Hudlicka, 2003). There is also human-machine interaction including social aware software based on user models and cognitive principals. This software uses knowledge, skills, believes and behaviors and can adapt to the situation. The main characteristic of these systems is affect behavior. The corner stone of "Affect software" is cognitive interface architecture.

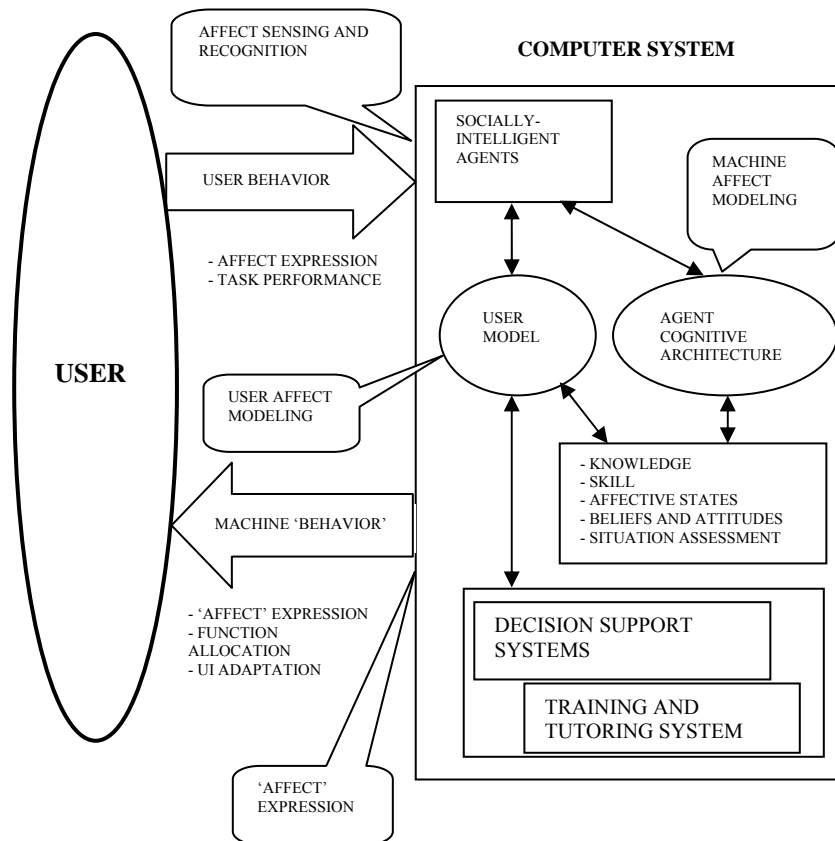


Figure 1. Framework for organizing affective HCI research. The figure depicts a human-machine system, explicitly indicating a range of possible system types on the right. This includes autonomous, socially intelligent agents (with their own cognitive architectures controlling their behavior), as well as range of decision-aids and tutoring systems. Both the agents and the more traditional systems may include explicit models of affect. The research areas of affective HCI are highlighted in the 'stickies': 'Affect Sensing and Recognition', 'User Affect Modeling', 'Machine Affect Modeling' and 'Machine Affect Expression'

Table 1. presents cognitive software dimensions (Burnett, 2003) which should be taken care of by software designer during making cognitive interface architecture.

Table 1. Designer's aspect of cognitive software dimensions

1. Abstraction gradient	What are the minimum and maximum levels of abstraction? Can fragments be encapsulated?
2. Closeness of mapping	What 'programming games' need to be learned? That is, can the user express problem solutions directly, without having to learn circuitous ways to cause the goal to be accomplished?
3. Consistency	When some of the language has been learnt, how much of the rest can be inferred?
4. Diffuseness	How many symbols or graphic entities are required to express a meaning?
5. Error-proneness	Does the design of the notation induce 'careless mistakes'?
6. Hard mental operations	Are there places where the user needs to resort to fingers or penciled annotation to keep track of what's happening?
7. Hidden dependencies	Is every dependency overtly indicated in both directions? Is the indication perceptual or only symbolic?
8. Premature commitment	Do programmers have to make decisions before they have the information they need?
9. Progressive evaluation	Can a partially-complete program be executed to obtain feedback on "How am I doing"?

10. Role-expressiveness	Can the reader see how each component of a program relates to the whole?
11. Secondary notation	Can programmers use layout, color, or other cues to convey extra meaning, above and beyond the 'official' semantics of the language?
12. Viscosity	How much effort is required to perform a single change?

These 12 points are the frame for program implementation of cognitive software aspects which is very important for educational applications. In order to carry out this in real conditions, it is necessary to define and successfully use appropriate HCI model. One of similar models is presented in the following chapter.

3. PiE AND RED-PiE MODELS

3.1 Criteria for Hci Design Modeling

This paper examines usage of mathematical models in interactive systems design and how can abstract level of these models influence on their usage in design human-computer interaction (HCI). This paper also deals with and discusses the role of formal models in interactive system development and presents three major criteria which can be used in comparing such models. Interaction models are user input description, application action and output presentation. Interaction models are based on formalisms which is enough for their implementation in the scope of tools for interface development. The formalism has also enabled some models to use and specify interface behavior on the lowest level.

According to (Dearden, 1997), HCI model design needs three criteria:

1. Operability. This criterion expresses measure in which the model follows designer's intentions.
2. Expressivity. Criterion related to the model's ability to show special characteristics of user-system interaction.

3. Re-usage. This criterion is related to the usage of model in wider domain of software applications.

The usage of the model for HCI design depends on obtained balance between these three criteria.

Most approaches to HCI modeling can be described as attempts of modeling interactive systems on one of two stated levels of abstraction, according to Dearden (1997), page 152:

- General mathematical approaches are designed to support generally appropriate characteristics of interactive systems, such as 'predictability
- Approach to modeling using software engineering terms for support detail specification of individual systems.

Took (1990) divides modeling approach into convergent and divergent one. The first one offers little operability and limited expressivity, while the second one loses re-usage in favor of expressivity and operability. Modeling on inter-level abstraction would enable significant advantages in relation to previous two approaches. The new approach includes constructing generic model for system class. This offers the expressivity and operability of convergent model, without losing the re-usage by common mathematical models.

Models in use are so called PiE and RED – PiE and Z model specification (Dearden, 1997). Models PiE and RED – PiE are presented in following chapters.

3.2 Pie Model

PiE model (Dix, 1991) presents interactive system behavior with four components (Dearden, 1997):

1. C: The set of commands
 2. P: The set of command sequences, which is made of commands from C set. P is usually called a program and it is the system's input.
 3. E: The set of effects which represent system's output.
 4. i: Interpretation function for mapping input program P into its appropriate effects E on system's output.
- Figure 2. shows PiE model.

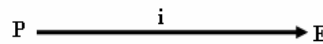


Figure 2. The PiE model

The system with predictable behavior can be expressed with PiE model on the condition that:

$$\forall p, q, r \in P : (i(p) = i(q) \Rightarrow i(p + r) = i(q + r))$$

If two input command sequences (two programs) p and q give equivalent result, any other extension r that extends p and q sequences always leads to equivalent effects.

PiE model has been upgraded so the user can foresee effects of his input commands or their sequences, using presented information. Upgraded PiE model is called RED-PiE model (Figure 3.).

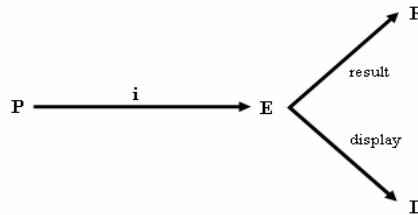


Figure 3. The RED-PiE model

RED-PiE model involves the set of effects of input commands which is mapped in two sets:

1. result set R
2. display set D.

Result set R is the model of processed object, after being exposed to effect E. Display set D has display of modeled object available to the user, so he can see the result of the effect caused by input command sequence P.

This approach, applied in RED-PiE model, enables the observation: the user can observe the current display's state and evaluate results. This principle has often been expressed by acronym WYSIWYG (What You See Is What You Get) :

$$\forall p, q \in P : (display(i(p)) = display(i(q)) \Rightarrow result(i(p)) = result(i(q)))$$

If two different command sequences, p and q , have equivalent displays, they will also have equivalent results. The display which can be seen by the user don't have to show all results of command sequences, but only some parts.

A good example of this is the alteration of font attributes in text processing by text editor. Command sequences include: size, shape and features of chosen font. The result is changed document and extended undo list of text processor, while the display which can be seen on the screen is the part of the text with entered alterations.

4. EXTENDED RED-PIE MODEL

This chapter includes some possibilities for extension of RED-PiE model by cognitive aspects of HCI. Apart from mapping effects E in sets R (results) and D (screen display), the effects are mapped in cognitive set Cg (Figure 4.). In other words, besides program result and screen display alteration, cognitive form of the application is also being changed i.e. the user can get some knowledge designed by HCI.

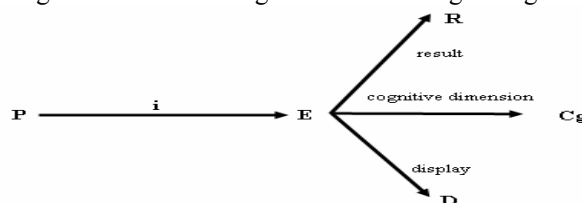


Figure 4. The RECgD-PiE model

Expressed by the formula:

$$\forall p, q \in P : (D(i(p)) = D(i(q)) \Rightarrow (R(i(p)) = R(i(q)) \wedge Cg(i(p)) = Cg(i(q))))$$

Two different command sequences, p and q , that make the same screen displays should give the same results and knowledge. This gives the opportunity to get the same knowledge using different sequences i.e. in many ways. Getting knowledge can be specific (appeals only to one user). In order to achieve this, software has to have a certain level of adaptability and affect behavior depending on user.

HCI designer can justify cognitive software dimension by defining the elements of Cg set. Extended RED-PiE model is a good basis for this approach. It can be seen in the following example.

System designer has to justify software system, using RECgD-PiE models, which for given x , calculates y according to following formula:

$$y = \begin{cases} 5x & \text{for } x < 0 \\ 0 & \text{for } x = 0 \\ 2x + 4 & \text{for other values} \end{cases}$$

Besides results and screen display, designer must also pay attention to cognitive aspect of the system i.e. he must have in mind which knowledge the user (student) is going to get while using this system.

System designer creates the set of possible commands C which are available to the user:

$C = \{\text{read}(x), x < 0?, x = 0?, \text{not}(x < 0)?, \text{not}(x = 0)?, y \leftarrow 5 * x, y \leftarrow 0, y \leftarrow 2 * x + 4, \text{write}(y)\}$,

and defines several possible command sequences (of the program):

$P1 = \text{read}(x), \text{not}(x < 0)?, \text{not}(x = 0)?, y \leftarrow 2 * x + 4, \text{write}(y).$

$P2 = \text{read}(x), x = 0?, y \leftarrow 0, \text{write}(y).$

$P3 = \text{read}(x), x < 0?, x = 0?, y \leftarrow 2 * x + 4, \text{write}(y).$

After that, he defines cognitive aspect for any possible program:

$Cg(P1)$: the user has mastered the algorithm that, for given x , calculates y because he knows if $x < 0$ and $x = 0$ is not true, y is $2 * x + 4$, which is true for “other x values” and is discussed at the end.

$Cg(P2)$: the user knows if $x = 0$, the result will be 0.

$Cg(P3)$: the user did not master the algorithm that, for given x , calculates y , because if $x < 0$ and $x = 0$, he will get $2 * x + 4$, and this is not in relation to task setting

Y has been calculated for each command sequence which is the effect of command sequence, $R(P1)$, $R(P2)$ and $R(P3)$ have been defined by this.

Each command sequence gives screen display: $D(P1)$, $D(P2)$ and $D(P3)$. Screen display can be block diagram of the algorithm suitable for command sequence with calculated y value.

RECgD-PiE model has been defined by this and it can be used for application development in appropriate environment.

4.1 Case Study of Recgd-Pie Model

It has been developed in Pascal (Delphi Architec 2005) program language. It has two purposes:

1. To carry out experiments on different systems, see its advantages and drawbacks and find possible ways for software development.
2. To display RECgD-PiE model possibilities using very simple examples.

The example used in this paper is very simple, exact mathematical example. In this RECgD-PiE model implementation the cognitive aspects of dealing with elements in certain order have been tested. This is not the unique approach to RECgD-PiE model implementation, but it is used due to the fact that it is simple and easy to describe.

Figure 5. shows the basic screen of developed software. The main functions of the program have been described in “hints”. Three parts of user interface can be seen:

Part “Task setting” including problem description and brief instructions.

Part “Commands” including available commands.

Part “Solution” including three empty command sequences. The user have to arrange commands in these sequences under the appropriate order.

The main part of the software includes the algorithm for analyzing defined sequences by the user i.e. analyzing command order. On the basis of predefined command order, the evaluation of cognitive elements

of solutions is being done. Depending on the results of this evaluation it is possible to carry out other activities. In this case, the actions are related to the description of user's cognitive elements, both in correct and incorrect answers. When the answers are completely correct, the user is show the block diagram of the algorithm.

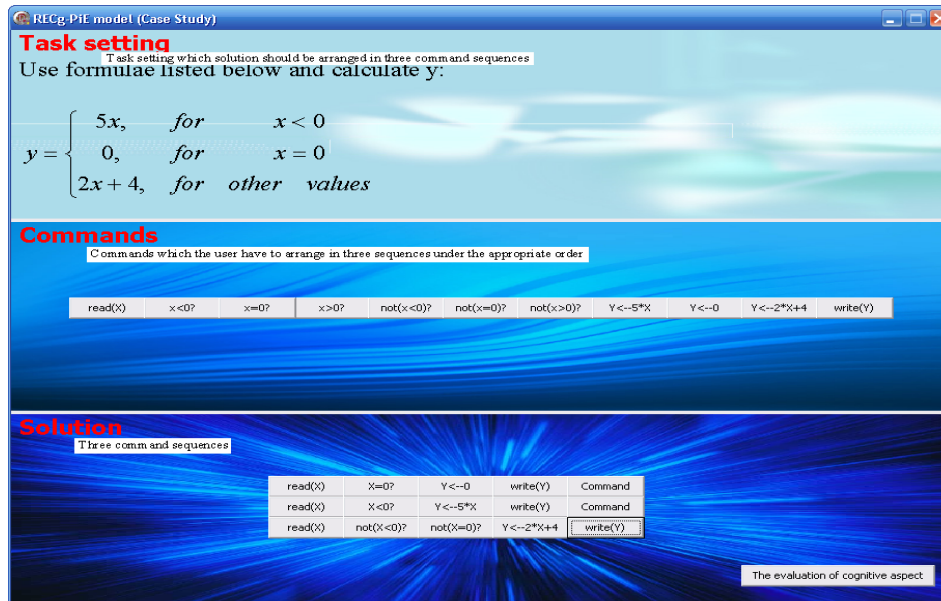


Figure 5. Basic program screen

Figure 6. shows screen display of possible solution (demo software has limited number of correct solutions). In this case, the user has arranged commands correctly and it provides the insight of the cognitive aspect of his knowledge.

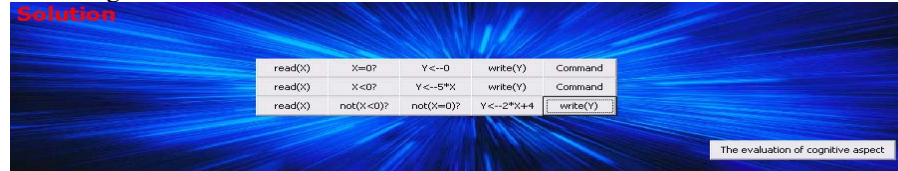


Figure 6. The user has entered the correct solution

To analyze the cognitive aspect, press “The evaluation of cognitive aspect” as shown in the following Figure 7.

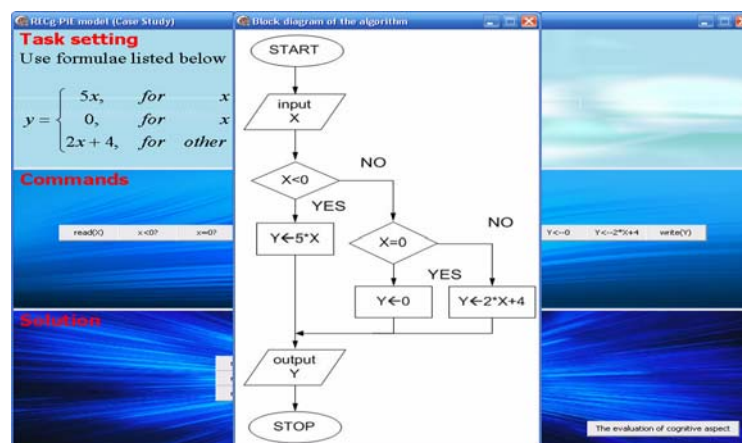


Figure 7. Screen display of correct solution

Screen display presented in the Figure 8. doesn't have to be presented to the user. Information related to the knowledge originated in his cognitive sphere is used for generating further tasks according to implemented model.

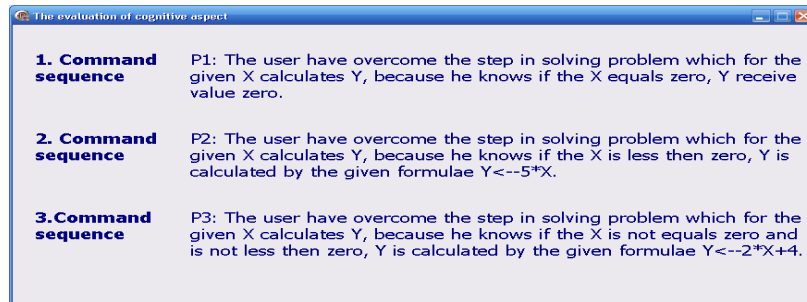


Figure 8. Screen display of cognitive aspect evaluation in case of correct answer

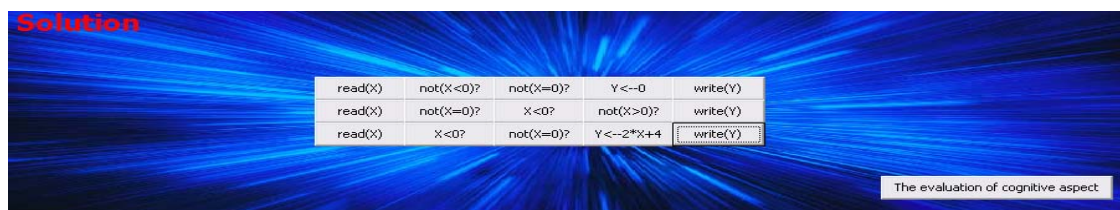


Figure 9. The user entered incorrect solution

When the incorrect solution has entered (Figure 9.), similar screen form is being generated (Figure 10.) as in the case of correct answers. This screen form doesn't have to be presented to the user either. Further steps are made in order to define next suitable task.

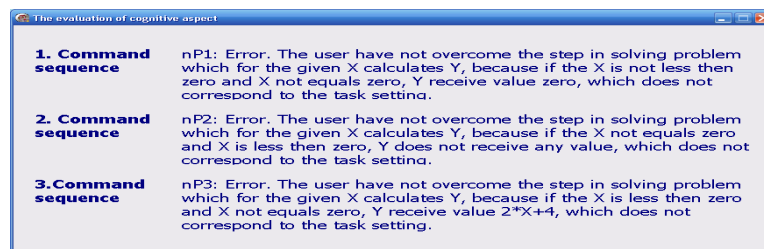


Figure 10. Screen display of evaluation of cognitive aspect in case of incorrect answer

5. CHARACTERISTICS OF COMMON MATHEMATICAL MODELS

The study of PiE models has shown that very abstract models can be used in expressing characteristics relevant for interface design. For example, predictability and observation are crucial for many but not each interactive system. Dix (1991) has shown the way of using PiE and RED-PiE in analyzing: text processors, graphic editor and windows managers. He has also shown the ways for using these models in analyzing detail system specification before its implementation. It can be seen that these models enable re-usage (Dearden, 1997).

5.1 Expressivity of Common Mathematical Models

Common mathematical models are not able to express characteristics of individual specific applications on higher levels. If you design HCI for managing data bases, it can be useful to specify that certain tables can be seen only by several users. PiE model can not express this characteristic because it doesn't deal with table

items. It can be concluded (Dix, 1991, Sufrin and He, 1990) that common mathematical models can be used for specification sub-sets of characteristics.

5.2 Operability of Common Mathematical Models

Dix defines PiE model as an inter-model trying to overcome divide between end users and formal system specification. Very important limitation of PiE models is that described characteristics in certain cases are not valuable for the whole system. This problem has been solved by introducing new level of abstraction, for example: text processor for printing can disable the display of the document occupying several screen displays. This problem is solved by introducing text scrolling command. Two sets of commands have been introduced in this way: commands for text editing and text scrolling. Further analyzing is carried out for each set separately. The level of abstraction depends on individual designer. Knowledge about HCI, PiE and RED-PiE models can help designers to form suitable characteristics of interaction. Otherwise, many important features will not be included in the system, while unimportant featured may further burden the interaction. It can be concluded that appropriate and successful usage of PiE models depends on designer's skill and his knowledge of HCI. Due to this fact, the knowledge involved in this model is not completely operative.

Common mathematical models enable knowledge on HCI to be encapsulated in the form which enables its re-usage (when applied in any interactive system). Unfortunately, when a designer describes this encapsulated knowledge, he needs a good knowledge on HCI principles, so this knowledge is not operative. Very abstract models are not able to express features related to certain system due to the fact that they do not include components related to specific parts of the system.

6. CONCLUSION

The development of software systems in HCI domain has increased in the last decade. Great intention has been drawn to the research of human-computer interactions including cognitive aspect. Many researches deal with cognitive aspect within HCI domain. This paper describes some of the problems that are usual for users (misunderstanding information presented on the screen-digital divide, disorientation). PiE model has been presented (**P**: set of command sequences made of commands from set C_i ; interpretation function for mapping input program **P** and its appropriate effects **E** at the system's output, **E**: the set of effects representing the output of the system) and RED-PiE (or upgraded PiE model. The set of results **R** is the model of object's state which is being processed, after being under the action of effect **E**. The set of displays **D** includes the display of modeled object available to the user so he is able to see the result of input command sequence **P**) which is an abstract model of software system made by software designer in order to enable users to overcome these problems. RED-PiE model extended by cognitive aspects has also been discussed. This model is called RECgD-PiE model (Besides mapping effects **E** in sets **R** (result) and **D** (screen display), the effects are also mapped in cognitive set **Cg** i.e. besides program result and screen display, the cognitive form of application is also changed, i.e. the user can get certain knowledge).

Using this model, system designer has to think of cognitive application aspects, i.e. to take care of knowledge obtained in application. Therefore, this model could be suitable for developing educational software. Further work deals with demo version including RECgD-PiE model and experiments carried out in different systems. The analysis of cognitive aspect of user's respond enables not only the correct-incorrect or knows-doesn't know analysis, but also the "finer" one. The analysis of cognitive aspect is one part of detailed analysis including the one of the affect user behavior. RECgD-PiE model can be extended by affect component which would be analyzed in order to get better performances. The extensions have not been limited. It is possible to analyze user's responds using motivation sphere. As these spheres are inter connected, it is necessary to find the model for this analysis. The basic principle of this analysis is feedback reaction of the system through user interface. Defining the intensity and the purpose of this action is crucial for the quality of communication and given effects. The development if this extended model can be one of the future developments.

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ANOTHER EFFECT OF UNDERLINING -EVALUATION OF THE EFFECTS OF UNDERLINING ON DISCUSSIONS IN THE BULLETIN BOARD SYSTEM-

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ABSTRACT

Computer-mediated worldwide networks have enabled a shift from contiguous learning groups to asynchronous distributed learning groups through the utilization of computer-supported collaborative learning (CSCL) environments. Especially, the Bulletin Board System (BBS) is an often-used communication and collaboration tool for promoting interaction among learners in higher education. However, the conventional BBS does not always allow active communication. Although several functions such as voting and personal profile have been added, the underlining function has not been installed in BBS and remains to be evaluated. Thus, we developed a system called uBBS that allows participants to underline text in posts and share the underlines. We examined two hypotheses: [1] underlining in BBS acts as the indicator of others' activities and a focus point indicator and [2] social presence in the uBBS is higher than that in the conventional BBS. Our results suggest that underlining in the BBS not only acts as the indicator of other participants' activities but also enhance the feeling like self-esteem. In addition, underlining acts as a focus point indicator, although social presence was not enhanced in the uBBS.

KEYWORDS

Collaborative learning, Interaction, Design of learning community, Underlining, Cognitive and socio-emotional aspects

1. INTRODUCTION

Computer-mediated worldwide networks have enabled a shift from contiguous learning groups to asynchronous distributed learning groups through the utilization of computer-supported collaborative learning (CSCL) environments. In CSCL, the promotion of interaction among learners plays an important role in the construction of knowledge and the solving of problems.

In Japan, the Bulletin Board System (BBS) is an often-used communication and collaboration tool for promoting interaction among learners in higher education (Takao et al. 2005). A BBS has the following two merits: First, the communications in a BBS are generally not usually limited by time and place (Kiesler et al. 1984). Second, the process of discussion can be recorded (Yoden 1990). These advantages enable those using a BBS to establish a shared interaction space for online groups.

However, the conventional BBS does not provide adequate support for social interaction (Pea 1999) owing to the following two reasons.

First, since a BBS provides a text-based environment that lacks nonverbal and social context cues (Sproull et al. 1986), the social presence of participants tends to be lower than that in a face-to-face environment (Figl 2008). Moreover, in a text-based environment, participants tend to feel lonely, and it becomes difficult for them to maintain social interactions. Short et al. (1976) put forth the social presence theory, which relates to one's subjective feeling that other people are also involved in the communicative process. In addition, Gunawardena (1995) argued that in a text-based environment, social interactions tend to

be unusually complex because mediation becomes necessary in group activities. She also suggested that “failures tend to occur at the social level far more than they do at the technical level.”

Second, it is difficult to comprehend social interactions in a shared virtual workspace (Gutwin 1995). He further stated that workspace awareness (the up-to-the-minute knowledge required by a participant about other participants’ interactions with the shared workspace) was inadequately supported. This awareness is essential for students to learn and work together effectively. However, awareness tends to be obstructed firstly by unequal participation among learners (the discussion is often led by an able learner, while learner with weak communication skills are not guaranteed the participation in the discussion (Eichinger 1991)) and secondly by the distributed nature of environment such as that by a BBS, which makes it hard for other learners to commit unless post.

Since the conventional BBS only provides one function, namely, the posting of messages, it does not facilitate continuous online discussions. In addition, lurkers reportedly make up the majority of members in online groups and discussion lists (DLs) in particular (Nonnecke 2000). Although it is important to forge an identity among community in online environments, their presence will disappear without efforts to post (Kim 2000). To resolve these issues, we focused on the *underlining* feature in bulletin board discussions and developed a system that enables users to underline certain parts of the posts.

Conventionally, underlining is one of the learning strategies (Weinstein et al. 1986) employed in self-schooling, particularly for the comprehension of instructional materials. Blanchard et al. (1987) stated that underlining is a process by which readers search for and select certain parts of reading materials that they regard as significant. Therefore, underlining is a personal activity that readers perform to highlight the parts they need or would like to focus on. Previous studies that have researched the effects of underlining have suggested that it is an effective method for reading comprehension (Uosaki et al. 2003). This study aims to examine how underlining affects discussions and participants.

2. PURPOSE OF UNDERLINING IN BBS

2.1 Functions of Underlining

This study argues that in addition to comments, the use of underlining can be an effective means of maintaining interaction in discussions. Since the conventional BBS provides only one function—namely, posting—it is difficult to indicate reading activity and highlight the parts that need to be focused upon without verbal postings. We consider underlined texts as an indicator of (1) learners’ participation and reading of the discussion log and (2) learners’ focus points concerning the discussion when the underlined parts are shared in the BBS.

(1): This implies that underlined texts may act as non-verbal cues that help participants be cognizant of the activities of other participant. Several studies have suggested that such non-verbal cues also help learners visualize the state of other learners in a shared virtual space. For example, Gutwin (1995) supported workspace awareness by sharing the position of each participant’s cursors in the shared virtual space.

(2) Underlined text in posts can also help learners relay their focus points to other participants in the discussion. We believe that the use of underlining in posts is effective for maintaining interactions because it serves to provide feedback on the posts.

From the above, we assume the following: First, the use of underlining enhances the cognitive aspects (e.g., the comprehension of discussions) of an online discussion, which is supported by previous research. Second, it also enhances the socio-emotional aspects of an online discussion, like the social presence of other participants, because underlined text serves as a non-verbal cue. In addition, we take into account Kreijns’s (2003) argument that social interactions not only have an “educational dimension” but also a “social (psychological) dimension” and that these dimensions are reinforced by each other. To confirm our hypothesis, we developed a special BBS.

2.2 Related Work

Takao et al. (2005) examined the effects of the voting function on BBS. The similarity between Takao et al. (2005) and this study is that both enable learners to provide their feedback on other learners’ posts without

verbal posts. They found that many participants use the voting function—which identified them personally—as an indication that they read another member’s post. However, the possible difference between our studies is that the underlining function allows a more specific indication of a member’s reading and comprehension of another’s posts than does the voting function.

Another related viewpoint is that underlining is one of the standard annotation styles. Given the advent of better computer support for reading and annotating, many systems have been developed to enable users to share annotations. Nokelainen et al. (2003) categorized annotation systems into two main groups: document-centered and discussion-centered. Whereas these systems allow annotating the existing documents, our systems allow annotating their own discussion log.

We propose the use of underlining as a means of promoting interaction in discussions. Furthermore, we examine not only the cognitive aspects but also the socio-emotional aspects—such as social presence—of online discussions. This is because we believe that since underlined text in posts serves as a direct feedback to the posters, it has a greater degree of effect on the posters’ perception than do the other two types of systems.

2.3 BBS with the Underlining Function (uBBS)

For our experiment, we developed a BBS in which participants could underline any part of their own discussion log and share the underlined parts with others. The underlining function was developed in order to allow users to indicate reading activity such that the parts that they focused on could be included specifically in the discussion. In more detail, this underlining function has two roles in the following:

- *Activity indicator*: It makes users aware of the fact that other users participate in and read past discussions. It also provides interactive information even from users who, in general, rarely or never post. This working schema is expected to guarantee participation in discussions by enabling users to visualize activities even if they do not verbal post.
- *Focus point indicator*: This enables users to indicate their comprehension of a discussion. In other words, the use of underlining is considered to be a means of highlighting the parts focused upon by the readers of the discussion. In addition to verbal posting, this method is expected to specify an individual’s point of view on a discussion.

We believe that our BBS also enhances social presence by using underlined text as a non-verbal cue.

We developed our BBS with the underlining function (uBBS) using Perl and JavaScript. The uBBS can be accessed through the web browser FireFox (Fig. 1).

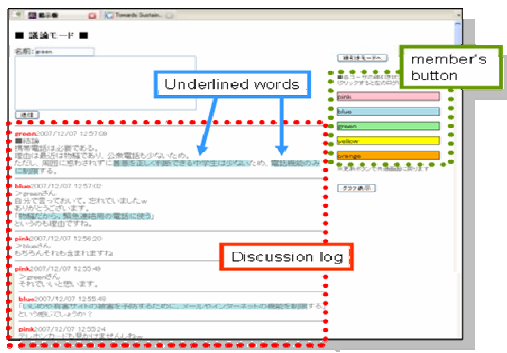


Figure 1. User interface of uBBS



Figure 2. Scene of the experiment

In the uBBS, users first underline certain words in the posts in the discussion log, and then, share each other’s underlined parts. Moreover, by using the member’s button, users can ascertain which parts of the posted messages are underlined as well as the user to whom the messages belong.

3. EXPERIMENT

Although a BBS is normally regarded as asynchronous communication, this experiment was conducted synchronously from a distance. This is because questionnaires were used to collect the data along the discussion.

3.1 Hypothesis

The following two hypotheses were constructed in this experiment.

- [1] The use of underlining in bulletin board discussions supports interaction from the viewpoints of *Activity indicator* and *Focus point indicator*.
- [2] The social presence of participants is higher when the uBBS is used than when a conventional BBS is used.

3.2 Subjects

The subjects of the experiment were 21 graduate students (12 males and 9 females). Their mean age was 23.9 (SD = 1.15). All subjects had prior experience in discussions using BBS.

Each group comprised 3 subjects (ID: pink, blue, and green). Each subject was accommodated in a separate room (Fig. 2). Note that all of the subjects were strangers to each other. Each underline was associated with a member ID. The subjects were informed that each group had 3 members.

3.3 Procedure

This experiment was conducted following a within-subjects design. Each subject used and evaluated two types of BBSs. In each environment, a discussion was held for 30 minutes. The discussion time was divided into sessions so that we could ascertain the phase of discussion that was affected by the use of underlining (this result is not provided in this paper). The discussion time was divided into three 10-minute sessions. Five minutes were allotted between each session of discussion to allow the subjects to underline text in the discussion log. In the BBS environment, subjects were asked to re-read instead of underlining parts.

Various questionnaires were used. Post-questionnaires for each BBS were administered to all the subjects after the discussions were completed, respectively. Another questionnaire on underlining/re-reading was administered twice, once in between the discussions and finally upon the completion of all the discussions. Fig. 3 presents the procedure (in time order) of the experiment followed in the case of Group 1. To avoid the order effect of systems and topics, we extended experimental design.

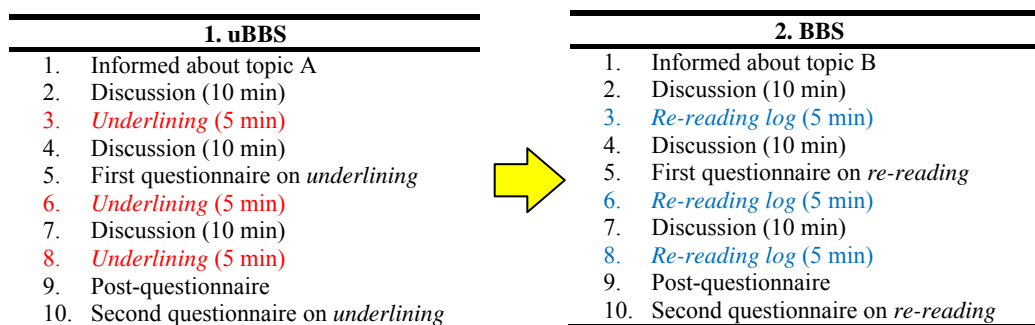


Figure 3. Procedure of the experiment in case of Group 1

3.3.1 Topic

The subjects were asked to discuss the following two topics in succession.

- Topic A: Is English education necessary for primary school students?
- Topic B: Are mobile phones necessary for primary school students?

Additionally, the subjects were also asked to compile their opinions into a “group” opinion.

3.3.2 Different Types of Questionnaire used for the Study

The main questions in the pre-questionnaire were aimed at measuring the apprehensions of users toward participating in group discussions.

The questionnaire on underlining/re-reading (The 5-point Likert scale) included direct questions on the activity of underlining/re-reading and on how the users felt when their posts were underlined/re-read. These questions were related to hypothesis [1]—whether the use of underlining acts as the indicator of others' activities and serves as a focus point indicator. The intermediate (first) and final (second) questionnaires had the same content.

The post-questionnaire for each BBS comprised two parts, one concerning the previous discussion (related to hypothesis [1]) and the other concerning social presence (related to hypothesis [2]).

The first part of the post-questionnaire concerned the previous discussion. Each subject was asked to rate items concerning his/her own discussion in the BBS. These items were related to hypothesis [1]. The questionnaires employed the 5-point Likert scale.

The second part concerned the SD measurement of social presence proposed by Short et al. (1976). Subjects were asked to rate the following six bipolar items on a 7-point Likert scale.

- passive – active · insensitive – sensitive · unsociable – sociable
- impersonal – personal · cold – hot · dehumanizing – humanizing

Using a 7-point Likert scale (e.g., 1: very “passive” to 7: very “active”), the subjects was asked to rate two of the above combinations of adjectives that matched or were similar to their feelings regarding their respective groups in the BBS. Based on the results of a factor analysis and two experiments, Short et al. (1976) concluded that these items influence the social presence factor. In each case, the adjective on the right-hand side (e.g., “active”) tended to show a stronger social presence.

4. RESULTS

4.1 General Findings

Our results show that underlining in the BBS not only acts as users' indicator of others' activity but also enhance the feeling like self-esteem. In addition, underlining acts as a focus point indicator, although social presence was not enhanced in the uBBS. We describe the detail in the following.

4.1.1 The Number of Posts

Seven groups conducted two discussions in each of the two environments. The average number of posts on the uBBS per group (Mean = 34.4, SD = 12.81) and on the conventional BBS per group (Mean = 33.4, SD = 8.92). The uBBS had a higher number of posts than the BBS. A *t*-test was performed in order to confirm the effect of the uBBS. There was no significant difference in terms of the number posts between the uBBS and BBS ($t(6) = 0.415$, n.s.).

All the groups underlined text in more than half of their own posts, especially in the uBBS. The average number of underlines per subject was more than 10 in each group (Tab. 1)

Table 1. Posts and underlining in uBBS

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
Posts	25	30	43	50	17	48	27
(underlined posts)	(16)	(17)	(22)	(27)	(10)	(26)	(16)
Average underlines/subjects	11.3	14.7	14.0	14.3	14.0	20.3	11.3

4.2 The Comparison by Different Categories

Hypothesis [1]: The attributes of activity indicator and focus point indicator were measured on the basis of two items each included in the first part of the post-questionnaire. The questionnaire on underlining/re-

reading was also used to measure activity indicator and focus point indicator. In addition, the first part of the post-questionnaire measured the influence of the comprehension of the discussion log (4 items) and the subsequent post (4 items). All the items in the first part of the post-questionnaire were measured by a 5-point Likert scale.

Fig. 4 shows the results for the four categories. According to the *t*-test results, a significant difference was observed between *focus point indicator* ($t(20) = 2.36, p < .05$) and *comprehension* ($t(20) = 2.37, p < .05$). In addition, a significant influence was observed with *activity indicator* ($t(20) = 1.92, p < .10$) and *effect on subsequent post* ($t(20) = 1.81, p < .10$).

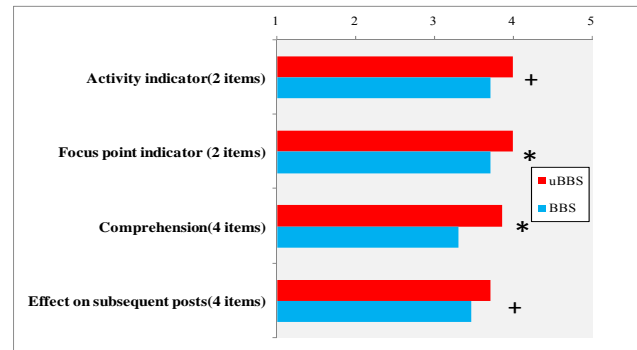


Figure 4. Results of post-questionnaires in each BBS
(* $p < .05$, + $p < .10$)

Tab. 2 presents all the items in the first part of the post-questionnaire (rated on a 5-point Likert scale) and the average response. For all the items, the uBBS received higher scores than the conventional BBS. According to the *t*-test results, a significant difference (participants' overall perception of the discussions in each BBS) was observed for the item "(5) It was easy to understand contents of this discussion" ($t(20) = 2.17, p < .05$).

Table 2. Difference in participants' perceptions on the discussion in each BBS

Category		Items	uBBS		BBS	
			M	SD	M	SD
Activity indicator	(1)	I think this discussion was active.	3.9	0.7	3.7	0.7
	(2)	I think other members read this discussion log fully.	4.0	0.7	3.9	0.7
Focus point indicator	(3)	I know which part other members took notice about. ⁺	3.9	0.8	3.4	0.9
	(4)	I think other members read my posts fully.	4.2	0.7	3.9	0.5
Comprehension	(5)	It was easy to understand contents of this discussion. *	4.0	0.7	3.5	1.0
	(6)	I was easy to understand which parts this discussion centered.	3.7	1.0	3.3	1.1
	(7)	I understood quickly the evolution of this discussion. *	4.0	0.6	3.3	1.3
	(8)	I understood fully the evolution of this discussion. ⁺	3.7	1.0	3.1	1.2
Effect on subsequent posts	(9)	I feel easy to post.	3.6	1.0	3.5	1.0
	(10)	I was afraid whether I could post which took into about others post. ⁺	2.9	1.1	3.4	0.9
	(11)	I post after I read this discussion log fully.	4.0	0.7	3.8	1.0
	(12)	I think past posts are useful in subsequent posts.	4.1	0.7	4.0	0.7

5-point Likert scale N = 21

(* $p < .05$, + $p < .10$)

The results indicated that the participants perceived the uBBS as effective in facilitating comprehension of the discussions. However, the post-questionnaire did not include direct questions on the use of underlining. The questionnaire on underlining/re-reading, which included direct questions on the subjects' underlining/re-reading actions, is thus useful for clarifying the reasons why the use of underlining facilitated comprehension.

4.2.1 Detailed Analysis of Participants' Perceptions

There were corresponding items in the questionnaires on the subjects' underlining actions in the uBBS and their re-reading actions in the conventional BBS (rated on a 5-point Likert scale) We performed a *t*-test for all the items.

In order to confirm whether underlining acts as an *activity indicator*, we tested the items (a) and (b). We found a significant difference between the items, which were as follows: "(a) I am interested in which part

other participants focused on in the past posts by underlining (re-reading)” ($t(20) = 2.45, p < .05$) and “(b) I feel that my posts are well re-read by others who underlined (re-read)” ($t(20) = 3.10, p < .01$). On the basis of these results, we suggest that underlining acts as the indicator of the other participants.

Additionally, in order to confirm whether underlining acts as a *focus point indicator*, we tested items (c), and (d). Significant differences were observed between items, two of which were as follows: “(c) I feel that my posts are paid attention to by others who underlined (re-read)” ($t(20) = 3.91, p < .01$) and “(d) I feel that my posts are helpful to others who underlined (re-read)” ($t(20) = 4.18, p < .01$). During the interview, some participants stated: “I could understand the other member’s focus point of my opinion by their underlines in my posts.” On the basis of these results, we suggest that the participants were aware of others’ focus points, especially when their own posts were underlined.

4.3 Social Presence

Hypothesis [2] : Social presence were measured on the basis of in the second part of the post-questionnaire.

Social presence score of uBBS, Mean=4.63(SD=0.54) and social presence scores of BBS, Mean=4.60(SD=0.71). uBBS received higher scores than BBS. However, the result from *t*-test indicates there was no significant difference in social presence scores between uBBS and BBS ($t(20) = 0.218, n.s.$).

4.4 Interview

Interviewee asked the subjects how you feel when underline others’ post/were underlined your post.

One subject (ID:blue) said “Firstly, I underlined posts for myself. However I changed the way of underlining so that my focus points come through others.” Moreover, ID:green said mobile phone was not necessary for primary school students while ID:pink said necessary. However, ID:green underlined the text of ID:pink’s posts. I felt that ID:green also paid attention to contrary posts to his/her opinions. ” This comment suggests that participants regard underline as tools for express their thoughts in addition to posts.

5. DISCUSSION

In this study, we examined how underlining affects online discussions and their participants. We hypothesized that [1] the use of underlining in bulletin board discussions acts as an activity indicator and a focus point indicator and [2] the social presence of participants is higher when the uBBS is used than when the conventional BBS is used.

Hypothesis [1] is supported by the post-questionnaire, the underlining/re-reading questionnaire, and the interview. We suggest that the participants regard underlines as a means to ascertain the focus point of other users and that the use of underlines raises the level of awareness of other participants’ activities. They are particularly aware of others’ focus points when their own posts are underlined by other participants.

Hypothesis [2] is not supported because of this experiment’s environment. The participants were only given a limited period of time for discussion (30 minutes per topic). Moreover, the synchronous discussion in this experiment made them provide immediate responses on posts. We assume that since posts always have a higher effect on social presence, the effect of underlines is reduced.

For similar reasons, there should be little difference between the numbers of posts in each BBS. The purpose of the underlining function is to maintain interaction in asynchronous discussions, owing to which we must conduct additional experiments in a long-term asynchronous environment.

6. CONCLUSIONS AND FUTURE TASKS

In this study, we examined interactive discussions in a BBS that used the underlining function and investigated the participants’ perceptions of underlining and underlined posts. Underlining proved to be useful in discussions and had a positive effect on participants’ perceptions. We were led to the following conclusions on underlining in bulletin board discussions.

1. The use of underlining acts the indicator of others' activities.
2. Furthermore, underlined text indicates one's focus points to other participants. In particular, participants become aware of others' focus points when their own posts are underlined by other participants.
3. However, the influence of underlines on *social presence* was not clarified in the environments created for the experiments.
4. The influence of underlining on the number of posts was also not clarified in the environments created for the experiments. However, it is possible that participants are motivated to post more frequently when their posts are underlined by other participants.

From these results, we presume that underlining promotes not only awareness of other participants' focus points but also the feeling like self-esteem, which leads them to deliberate on their opinions and their subsequent posts. We believe that these perceptions about others and themselves have an effect on social presence and facilitate interaction in an asynchronous discussion environment. To establish this estimation, we shall conduct further research in a long-term and asynchronous environment.

ACKNOWLEDMENT

This work was supported by KAKENHI (1930027).

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A LEAST WEIGHTED DISTANCE APPROACH TO THE DOCTORAL STUDENT SELECTION PROBLEM

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ABSTRACT

The Admission process to a doctoral program in any University is generally a long and tedious task for the applicants and committee members. From the committee's side, there are many candidates, with distinct cultural backgrounds, test results, research backgrounds, Letters of Recommendation, and various other aspects, which have to be taken into account during discussions. This is time-consuming, and in most cases decisions are not trivial, making it possible that subjective factors rule out several qualified applicants. On the other hand, the process should ideally be objective and, most importantly, have the result of enrolling into campus the candidates more prone to be successful in their doctoral studies. From the point of view of the students, the uncertainty, high costs of applications and the amount of time spent in preparing and sending documents to every institution are some of the drawbacks that the current system presents. Additionally, applicants have to go through all this trouble to end up enrolling into a single University. On this paper, we explore more into these difficulties, examining concrete evidence that the current system should be upgraded into a semi-automatic process, in order to mitigate many disadvantages. We also propose a method that employs a measure called the Least Weighted Distance (LWD) in order to rank the pool of applicants and select the best candidates for admission. The idea is to select the individuals that are closer to the hypothetical perfect student. However, as factors have different importance (i.e. Research Background is generally considered more valuable than G.P.A.), we assign a weight to each of them in order to get a more realistic notion of the distance to the optimum. A Web Application prototype that implements the approach has been created.

KEYWORDS

doctoral student selection problem , education, multi-criteria decision making.

1. INTRODUCTION

The admission process to a PhD program in any University is a long, tedious, expensive and difficult task for both the committee and the applicants. From the committee's side, there are generally many applicants (all with different cultural, educational and research backgrounds)[Zhao, Y.-2002], a considerable amount of time must be spent reviewing and discussing an applicant's potential, prediction of likely success[Burton, N.W., Wang, M.-2005] must be made and other various issues are involved. On the other hand, many students do not have an accurate estimation mechanism to predict which universities are more likely to accept them, other than speculating about information given by the institution's website (like average GRE test results for accepted students) or orientation from an advising professor. In practice, a vast quantity of money is spent by the applicant in sending documents, results, taking tests and paying applications fee in a blind way, because uncertainty of admission results is always present[Ward, N.-2007]. This process is only done in order to get into a single University, so a lot of resources and time should be saved. In some other cases, the results are even more dramatic, when the applicant does not even get admitted into a program. Informal overviews on the admission/application to PhD programs in CS can be consulted in[Pottinger, R.-1999][Harchol-Balter, M.-2004].

Because of the difficulties for both parties, some improvements over the current system must be made. The process should be automated to the maximum extent and admit into the University the best qualified students. That is, it would be of great benefit to have a tool which predicted objectively the best candidates for the graduate program.

Nevertheless, creating an automatic tool for this analysis does not seem possible, as there are intrinsically subjective factors present in the categorization of students. Some aspects like evaluating a Statement of Purpose and assessing Letters of Recommendation do not seem to be capable of being coldly analyzed by a machine. On the other hand, other criteria like GRE Scores and G.P.A. are obviously numerical, and may allow the ranking of candidates. This last point offers some hope into how much the process can be mechanized. Despite the fact that some criteria cannot be evaluated strictly by a machine, it might be possible to analyze manually Letters of Recommendation and Statements of Purpose by a couple of reviewers, as it is done for conference papers, and then submit their averaged evaluations into this hypothetical machine, with the purpose of starting the selection process.

A plausible mechanism for doctoral student selection consists in reviewing manually the material which has intrinsic subjective elements and inputting their weighted evaluation with the other objective and numerical criteria into a tool that outputs the rank of the most likely individuals to contribute to society after having obtained their PhD degree.

Regarding the machine that takes the input, it should be very flexible, as many Universities have different criteria for what they consider the best candidates (some take very seriously GRE, while others are more research oriented). Therefore, this machine should consider not only the candidates and their numerical values, but also a small specification regarding the importance of every criteria. Because of the problem's nature, we believe that Multi Criteria Decision Making (MCDM)[Yu, P.L.-1989] is more suitable to the task than other methods.

The Doctoral student Selection Problem was first stated in [Carlsson, C. et. al.-1997], where they also employed Ordered Weighted Averaging (OWA)[Yager, R.R.-1988]. For an extensive survey on Aggregation for selection problems see[Smolikova, R., Wachowiak, N.-2002]. Basically, their proposal consists in assigning weight to the different criteria, and then calculating the sum of the products of every weight and numerical value for each factor as an indicator of the student potential. This is the most widely used method for the problem, however the difficulty strives in selecting each weight for the model to be useful. A proposal of a model for Graduate Student Admission is presented in [Ward, N.-2006], which also gives a normalized numerical value for students and recommends a threshold for a handful of universities. As stated on the last method, it gives only rough approximate to weight consideration. Additionally, some applicants may be given a negative value(!). Besides OWA, ELECTRE III methodology has been an application for Multi Criteria Decision to the doctoral student selection problem[Leyva-Lopez, J.C.-2005]. Another important related work is the aggregation method for fuzzy preference relations[Wang, Y., Fan, Z.-2007], which as the name implies, permits a combination of fuzzy preference in order to state a relation between the criteria.

In our paper, we give a more detailed explanation on why automating the process of admission of doctoral students into a PhD program would be of great benefit. Afterwards, we propose a mechanism for achieving this automation at least partially, in order to mitigate the burden for the applicants and admissions committee. Our proposal consists on determining the closest individuals to the optimal value (the perfect student), giving a weight vector that describes the importance of every factor. More important criteria have greater weight, meaning that a difference between two candidates in that area may generate a greater gap in the ranking. We call this method the Least Weighted Distance Approach. The resulting pool of students which is offered admission is called the Least Weighted Distance Set.

The organization of the paper is as follows. On section 2, we present formally the problem. Section 3 addresses the importance of automating the doctoral student selection process. Section 4 presents our proposal for approaching the problem. An example is presented on Section 5. Section 6 contains the concluding remarks .

2. DESCRIPTION OF THE PROBLEM

The doctoral student selection problem was first described in [Carlsson, C. et. al.-1997] through an OWA application[Yager, R.R.-1988]. The problem consists on a procedure that occurs every year on graduate schools. A set of applicants with distinct background, qualities and weaknesses are considered for admission into a doctoral program in an University. The number of individuals surpasses the capacity of the program, so the most likely to succeed in it are to be chosen for acceptance. Additionally, exceptional candidates are offered Research or Teaching Assistantships, as well as Fellowships.

For the selection process to be carried out, applicants are required to submit data like GRE Scores, G.P.A., Letters of Recommendation, Statement of Purpose and Publications (if any). The admission process starts with committee members assessing every candidate's virtues and weaknesses, and evaluating the department's needs (students for solicited areas are more seriously considered), trying to predict the potential of the candidate. This results in discarding evidently weak candidates, while keeping stronger students. As the process gets in its last deliberations, highly qualified students remain, and the task of elimination gets tougher. In fact, many good candidates may get turned down because of uncertainty on how to compare students or other subjective factors. Finally, after the last discussion, the remaining pool of applicants considered for admission is obtained. This takes generally from 4 to 5 months, and respective decisions are sent to every applicant.

Formally, an applicant is modeled as an n -tuple, where n is the number of criteria used for evaluation (G.P.A., GRE Scores, Letters of Recommendation, etc.). For every criteria (element in the tuple), a number ranging from 1 to 3 (Weak, Average and Excellent) [Carlsson, C. et. al.-1997] is used to express the performance of the individual. For example, a GRE score of 1600 ($V=800$, $Q=800$) represents 3 and a score of 200 is 1.

The problem consists in selecting the best S candidates from a Set C of n -tuples, where S is the number of available seats for the PhD program in consideration.

3. IMPORTANCE OF AUTOMATING THE PROBLEM

There are many issues regarding the current admission process of doctoral programs that make it subject to revision. These have been briefly described in the introduction and now there are more extensively discussed.

- **Time Spent by the Admissions Committee :** The members of admission committees are some of the most qualified components of a department's faculty. This is logical, because such an important decision as determining the students who will form part of the staff for the next 4 to 5 years should be left on very responsible, analytical and well-prepared individuals. However, as a consequence, these are generally the most occupied personnel, with conferences to attend to, lectures to give and research projects with external funding to finish. Therefore, the process takes months of deliberation and staff members suffer from exhaustion, making it more difficult for them to carry on with their other obligations. Because the task is repeated every year, and the number of applicants tends to increase, human resources employed on the process are becoming considerable.
- **Extensive and Diverse Information has to be handled by the Committee :** During recent years, applicants seem to be growing in numbers [Zhao, Y.-2002]. As a consequence, more transcripts are sent and many information has to be reviewed and discussed a number of times. The amount of data and factors to be considered by the committee throughout the process is enormous, so it would be preferable that a machine carried out information processing tasks to the maximum possible extent, minimizing potential sources of errors.
- **Possibility to lose ideal candidates because of late decisions:** As the process of deciding the admission of the candidates takes some time, Universities that make decisions more quickly may have better chances of attracting the best students. For example, if a top tier University informs an exceptional student that he/she has been admitted and gives him/her a deadline to inform the decision of acceptance or rejection, and if the offer entails an RA or TA, it is very likely that the candidate will reject other similarly ranked schools and accept the offer. Therefore, Universities in the current system also have to compete in order to attract the best candidates into enrollment by informing admission decision as soon as possible. Hence, automating the process of admission selection can diminish substantially the time taken to make decisions and improve the chances of the University to get the most promising students.
- **Implicit monetary losses for the University:** This is also related to the first point (time spent by the committee). As it is widely known, many Universities receive funding from the government and other external entities, proportional to its research production. The time consumed during deliberation of doctoral student selection entails giving up staff and research hours away for a few months. Mechanizing this process would render these valuable human resources available for full-time production, making the institution more attractive for outside funding.

- **Uncertainty of the System[Ward, N.-2007]:** Although a tool that mechanizes the admission process would not escape from this problem (as it needs the criteria input and evaluation from the user), it would be a model with deterministic and predictable behavior. On the other hand, long deliberations and wide information handling may difficult the committee's task to an extent, that it would not possible to assure that the best and promising candidates get accepted.
- **Time and Resources spent by Applicants:** On the candidates side, the current system has many drawbacks. Generally, individuals seeking admission on a doctoral program apply from 5 to 10 Universities, enrolling into a single one. A lot of time is spent writing the Statement of Purpose, searching over the web for admission statistics, requesting Letter of Recommendation, and other activities. Additionally, application fees typically range from 40 to 65 US \$[Pottinger, R.-1999] and additional test score reports cost US \$ 20 for the GRE and US \$ 17 for the TOEFL (www.ets.org). Ideally, a tool should predict the chances of a candidate, given an approximate admission criteria for a graduate program. Therefore, it could be a possibility that the Universities published in their page a specification of their requirements so applicants could use the tool and get a more realistic view on what their opportunities really are.

4. THE LEAST WEIGHTED DISTANCE APPROACH

We now present our method for approximating the doctoral student selection problem, called the **Least Weighted Distance (LWD)**. The resulting pool of candidates is defined as the Least Weighted Distance Set.

To explain this method it is necessary to give a few formal definitions:

- **Definition 1 (Distance) :** Given n-tuples $A = (a_1, a_2, \dots, a_n)$ and $B = (b_1, b_2, \dots, b_n)$, where $a_i, b_j \in \{1..3\}$ for each $i, j \in \{1, 2, \dots, n\}$, and $a_k \leq b_k$ for $k \in \{1, 2, \dots, n\}$. The distance **from A to B** is defined as

$$D(A, B) = \sum_{i=1}^n (b_i - a_i).$$

- **Definition 2 (Weight Vector) :** A weight vector is an n-tuple $W = (w_1, w_2, \dots, w_n)$, where $0 \leq w_i \leq 1$ for $i \in \{1, 2, \dots, n\}$ and $\sum_{i=1}^n w_i = 1$.

- **Definition 2 (Weighted Distance):** Given n-tuples $A = (a_1, a_2, \dots, a_n)$ and $B = (b_1, b_2, \dots, b_n)$, where $a_i, b_j \in \{1..3\}$ for each $i, j \in \{1, 2, \dots, n\}$, and $a_k \leq b_k$ for $k \in \{1, 2, \dots, n\}$. The Weighted Distance **from A to**

$$B \text{ with respect to a Weight Vector } W \text{ is denoted by : } D_W(A, B) = \sum_{i=1}^n w_i (b_i - a_i).$$

- **Definition 3 (Least Operator):** Given a finite subset of the Real numbers X, and an integer S ($S \leq |X|$). The least S elements of X are denoted by $Least_S(X)$.
- **Definition 4 (Least Weighted Distance Set) :** Given an a set X of n-tuples, a Weighted Vector W, an integer S ($S \leq |X|$) and an n-tuple T. Suppose that the Distance from every element in X to T is defined. The Least Weighted Distance Set of size S, with respect to W, **from X to T** is calculated as follows : $LWDS_S^W(X, T) = Least_S(\{D_W(X_i, T) : X_i \in X\})$.

Basically, the Distance from an n-tuple to another is the sum of the individual differences, when every component of the first is not greater than the corresponding component of the second one. The Weighted Distance again calculates the difference in components, but each criteria does not have the same contribution to the result. This is given by the Weight Vector. The Least Operator intuitively consists of selecting the least S numbers from a subset for the Reals. Finally, the Least Weighted Distance Set is the collection of elements that have the Least Weighted distance to an element of interest.

Now follows an pseudo-code that shows how to calculate the Least Weighted Distance Set (Figure 1).

```

Procedure LeastWeightedDistanceSet(Set<Tuple> X,Int S, Tuple T, Tuple W,int N):
L <- Empty Set of 2-Tuples ;
for each Tuple A in X do
    sum <- 0;
    for i <- 1 to N do
        sum <- sum + W[i]*(T[i]-A[i]);
    insert (A,sum) in L;
sort L in increasing sum value;
R<- Set of the first components of the first S elements in L;
return R;

```

Figure 1. Pseudo-code for Calculating the Least Weighted Distance Set

Having stated all necessary definitions, we describe the motivation of our method for tackling the doctoral student selection problem.

As we mentioned before, the most widely used methods for approaching the doctoral student selection problem have relied on the framework of MCDM. This is natural, as we have a degree of uncertainty which can be modeled in fuzzy logic. Also, OWA permits the combination of these criteria evaluation in a way that matches the problem's characteristics, by giving different weight to each criteria (many Universities value research background over G.P.A., although all the criteria are considered as a whole when rejecting or accepting a candidate).

Thinking of another approaches, say Multi-Objective Optimization (MOO)[Steuer, R.E.-1986], does not seem so sound. Basically, because MOO relies on searching through possible tuples in order to find a combination that yields the optimum or a very close value in a reasonable time. However, we already know the optimum in this case: the perfect student, (perfect scores in G.R.E., TOEFL if it applies, G.P.A., excellent Letters of Recommendation and Statement of Purpose, etc.). Therefore, no search is really necessary, as ranking is more to the point. The idea is to classify the pool of individuals and select for admission the best qualified.

In our proposal, instead of weighting criteria in order to give a numerical "fitness" to each candidate, we choose to calculate the Distance of the individuals to the perfect student (as we know its characteristics). Because the criteria have different importance, the distance is weighted according to their relevance in the admission process.

The motivation is to rank the candidates according to the weighted distance with respect to the optimal value. The applicants with the least weighted distance to the hypothetical candidate are selected. Regarding the selection of the weight vector, the most important criteria should have the greatest weight with analogous assignment to the least important criteria, and intermediate for the ones in the middle. The reason is that a greater weight can set up a major difference between two candidates, if one has a better evaluation in that area than the other. This is how the admission process should be carried out according to our proposal:

- 1) Receive the applications, consisting of **G.P.A. , name of the institution where undergraduate title was obtained, Letters of Recommendation, Statement of Purpose, GRE Scores and research background** (this includes publications and relation to faculty members interests).
- 2) Classify with a number from 1 to 3 (Weak to Excellent) the numerical values like the GRE Scores, reputation of the Undergraduate institution and G.P.A. According to statistics like percentile of the GRE, people admitted to the University and studies about the institution in question.
- 3) Submit the Letters of Recommendation, Statement of Purpose and research background to a blind dual refereeing process. That is, every Letter of Recommendation (typically 3 in total) is reviewed by two members of the committee without knowing anything about the applicant, giving finally a grade from 1 to 3. If their verdicts differ by more than one point a third referee is called upon, giving the final qualification. If not, the two verdicts are averaged and this correspond to the evaluation for that criteria. For three letters of Recommendation, the values are averaged and the result is considered the evaluation for this criteria. Similarly, this process can be carried out for the Statement of Purpose and research background, where the referees should evaluate the clearness,

soundness and motivation on the former, and the relation to the faculty and quality/quantity of publications regarding the latter criteria.

- 4) Having obtained the numerical value for each criteria evaluation for every applicant, the process of assessment has been carried out, needing only to give an importance to the factors in order to rank the candidates and select the best ones for admission. A weight vector, as defined previously, should be selected according to the relevance of the criteria for the admission decision.
- 5) Use the algorithm presented in figure 1 to rank the set of candidates and obtain the most qualified individuals with respect to the given Weight Vector. For this purpose, a Web Application is an alternative for implementing the tool with an user friendly interface.

5. A BRIEF EXAMPLE

The method of calculating the applicants to be selected has been stated in the previous section. We now present an example of the approach. A Web Application prototype that we propose to be used for the doctoral student selection problem can be downloaded at <http://www ldc.usb.ve/~olivo/DSP/>. The following simple example consists of a group of 5 applicants with different evaluations, from which only 2 will be offered admission. In table 1, we present the candidates with their evaluations resulting from carrying out steps 1-3 of section 4.

Table 1. Applicants with values regarding the performance on each admission criteria

Applicant	LOR	SOP	Research	G.P.A.	Undergrad Institution	GRE
A1	2.0	2.0	2.0	2.5	2.0	2.5
A2	2.5	2.0	2.5	2.5	2.75	1.5
A3	1.5	1.75	2.0	2.5	3.0	3.0
A4	3.0	2.5	1.75	3.0	2.75	2.75
A5	3.0	2.75	1.0	2.25	1.5	3.0

The perfect applicant is the 6-tuple $P=(3.0,3.0,3.0,3.0,3.0,3.0)$.

A weight vector is needed in order to determine the importance of every criteria. A possible assignment could be LOR=0.2 , SOP=0.2 , Research=0.3, G.P.A.=0.1, Undergrad Institution=0.1, GRE=0.1. However, this may vary according to the University.

In Table 2 we present the Weighted Distance from every candidate to the perfect student P.

Table 2. Weighted Distance from each applicant to the optimal

Applicant	Weighted Distance to Optimum
A1	0.9
A2	0.675
A3	0.9
A4	0.525
A5	0.875

As only two individuals will be offered admission, A2 and A4 are the candidates chosen, because they are closer to the optimal. This is reasonable, as A4 has a great performance on every criteria except for research (which is not a prerequisite for admission to a PhD program, although it helps), and A2 has a very good performance overall and outstanding research background, while his/her GRE Score may have been a bad day. A3 may seem promising as it has an excellent GRE and comes from a recognized institution, with a very good G.P.A.. Nevertheless, the weak performance on the SOP and LORs, also with an average Research background rule him/her out. A5 has an excellent GRE and LOR, but because the University from which he

comes from is hardly recognized, the committee may not have enough confidence to rule out A2 or A4 over this candidate. Also, a very weak research background may be a product of no real correlation with the faculty's interests and no publications. Despite of this, this applicant would have been admitted if A2 and A4 were not in the pool.

6. CONCLUSION

We have described thoroughly the doctoral student selection problem, giving not only a formal statement but also describing the limitations of the current system to approach it. Human and Economical resources are being spent every year in order to select the candidates to be accepted in the program. Additionally, the complexity of information handling and decision making render this process with a degree of uncertainty[Ward, N.-2007] that applicants do not know where to apply and committee members have to deliberate many months. For the mentioned reasons, we proposed an approach that, for a given set applicants and a tuple of criteria with associated weight corresponding to the importance, ranks the individual according to the Least Weighted Distance to the hypothetical perfect student. Therefore, instead of discussing for a long time on the candidates information, documents like the LORs, SOP and Research Background are subject to blind refereeing, while others like GRE Scores, G.P.A. and prestige of the Undergraduate University are given a value according to statistics. These results are the input of the tool, along with a criteria vector for the subsequent ranking.

Our approach indeed takes off some of the committee's burden. However, there are still limitations in the model, which we now state as avenues for future research. The weight of each criteria is determined manually by the user. A guidance about this value would render the method even more useful. Fuzzy Logic Quantifiers[Chandramohan, A., Rao, M.V.C.-2005] may be suitable for this task. Additionally, weight vectors could be calculated according to previous decision and admitted students performance statistics. Given that the weighted distance permits different scaling factors (not all criteria rated from 1 to 3), it could be interesting to investigate the effect of it on the model. For example, it is more intuitive to rate the GRE test results with a scale from 1 to 5 than 1 to 3 (using the percentile in published by ETS in www.ets.org), while SOPs may still be qualified on a 1 to 3 range. Another fact is that many Universities consider diversity in the admission process[Humphreys, S.-2002]. It is beneficial to admit qualified candidates from diverse backgrounds, in order to create a balanced staff of teaching and researchers in the department. Our approach does not measure this, although it could be implemented as an additional criteria, with the condition that it is not favored to the extent of surpassing more relevant factors. Finally, it would be advisable to investigate the proposed application from the candidate's side. As it was presented, the tool ranks the student within the candidate pool, so comparing with the current applicants may not be possible. Nevertheless, it could be interesting that Universities presented admission statistics in their pages, along with their particular Weight Vector, so that applicants could obtain a realistic perspective on their possibilities to get admitted.

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PITFALLS ALONG THE PATH FROM INNOVATIVE IDEAS THROUGH DEVELOPMENT TO THE MARKET

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ABSTRACT

In the pre-www era, schools in Norway wanted a communication system for exchange and collaboration. A requirement specification was set up, focusing on user friendliness, flexibility, distributed databases, transmission of formatted texts, pictures etc. Gradually innovative ideas at the time were embedded and the whole package grew beyond initial plans, catching attention also outside education. The combination of Windows and UNIX led to the name WINIX, a product that was really breaking barriers at the time. It was presented e.g. at the COMDEX Spring and COMDEX Fall 1991, at the TELECOM'91, at a UNESCO conference and for the DELTA programme in 1992. The reactions were overwhelming, through articles in international magazines, direct contacts from IBM, AT&T, NCR, Sun Microsystems, Motorola – and a personal visit by Bill Gates. Positive evaluations were presented by IDC and Market Share. The success seemed obvious. The Norwegian Ministry of Education had financed the development through contracted expert groups. They kept copy rights tight to their chest despite tempting bids in the multimillion class, and established their own business group, WINIX Ltd for making the maximum out of their golden egg. Lack of capital and inability to act and decide, however, caused potential customers to give up, and made the whole business idea wither. A fore-runner of WWW did not make it beyond development due to faulty business organisation.

KEYWORDS

Communication system, innovation, toolkits, multimedia, marketing, business organisation.

1. INTRODUCTION

The history of the Winix software system goes back to 1987, initially named PEGASUS. The Ministry of Education wanted to establish close collaboration between secondary schools in Northern Norway (Pegasus 1, 2 & 3, 1988). The distances between the schools were several hundred kilometres, and some schools, like *Honningsvåg fisheries and secondary school*, had several branches along the coast of Finnmark. Several communication systems like Teleboks (Norwegian Telecom), PROCOMM, Kermit etc. were tested. For long-distance telephone connections these systems were very expensive, and for data-transmission they were also inefficient.

Since none of the systems offered satisfactory solutions to the educational needs, development of a new system seemed necessary. This was done, and the first net based vocational education for the professional certificate of fish farming through the Winix Network and Internet was completed in 1989, for students attending different schools and branches of schools.

1.1 Requirements

The purpose for development was to develop a system that would facilitate and incorporate

- **a strategy for** cooperation, information exchange, user-friendliness, reduced telecosts, exploitation of previous investments using prevalent software standards like MS-Windows, UNIX, TCP/IP etc

- **a concept for** distributed databases (structured/unstructured data, pictures, objects), using low-cost data-power (PC/AT as workstations i.e.), distributed conferences etc.
- **a tool for** distance education, distributed databases, environment control etc.

The total package should cover all communication needs between computers, it should offer a simple user interface and provide more flexible applications than the many separate services which already were available. An overall goal for the development was to gain pedagogical, technological and organisational experiences with tele-education and distributed work situations.

The major test environments for the development and application of Pegasus/Winix were:

- SPINN (School Project In Northern Norway) consisting of 4 sub-projects (SPINN 1992)
- SIRNETT (Schools In Regional NET(T)work) (SIRNETT 1989), a project to maintain broad variation of subjects & streams, improve quality of education, evaluate costs with net based education and establish a course- and resource centre.
- Naval district of Eastern Norway distance education for personnel and announcements of vacancies from employment agencies to all naval stations

In addition to educational requirements in Norway, some international standards had to be considered.

1.1.1 Internet, the Fast Growing Data Communication Highway

In the 1980-ies the number of local nets using TCP/IP - and also the number of TCP/IP vendors - was growing very fast. The dominant model for Internet work was ARPANET/ Internet with an emergence of a world-wide data communication. In 1987 ARPANET/Internet was estimated to have several hundred thousand computers connected – and perhaps as many as one million users.

1.1.2 Windows, the New PC Standard

Most computers in the schools were running MS-DOS. Some few were applying Apple Macintosh with its graphical interface. The introduction of MS-Windows changed the interface of PCs for non-professionals.

- **Windows 2.0**, introduced in the fall of 1987, provided significant usability improvements to Windows. With the addition of icons and overlapping windows, Windows became a viable environment for development of major applications
- **Windows 3.0**, released in May, 1990, was a complete overhaul of the Windows environment, with the capability to address memory beyond 640K and a much more powerful user interface
- **Windows 3.1**, released in April, 1992 provided significant improvements to Windows 3.0.

All programmes running Windows must follow the same general guidelines for user interface. Windows was quickly gaining popularity, and Microsoft soon sold more than 10 million copies. But Windows was made for simple PCs and was lacking a powerful networking environment.

1.1.3 UNIX for Networking

Many organizations at that time were moving towards distributed models of networked computing. Years of research and development had given UNIX a powerful and sociable identity with its great power in distributed, heterogeneous networks. TCP and IP (TCP/IP) protocols were the standards of the Internet, which was dominated by UNIX servers.

Because of its flexibility and expandability, UNIX was gaining popularity among corporate users faced with the challenges of managing diversified and complex computing environments. UNIX gave promises for flexible communication, multiple hardware options, distributed applications, connection of dissimilar computers, and represented an alternative to limited PC technologies.

2. DEVELOPING WINIX

Since no software on the shelf at the time could meet the requirements outlined above, the Norwegian Ministry of Education, Research and Church affairs and its task force saw no other solution to the challenge than to initiate development of its own communication tool. Given the facts above, the clue seemed to be a combination of Windows and UNIX to exploit the power of Internet.

2.1 Integration of Windows and UNIX

In short, UNIX gave promises to be the “glue” that integrated diversified desktops in computing environments, while providing functionality for the next generation of “open systems”. By most market standards, however, the level of UNIX/PC integration available was a clear obstacle to a broader implementation of UNIX-based, client-server environments.

With the introduction of Windows by Microsoft, especially after introduction of Windows 3.0 and its broad market acceptance, users were becoming less willing to cope with the current level of LAN/server integration. Users were demanding server integration that preserved their Windows environment while delivering the power and the flexibility of UNIX. Seamless, transparent integration of UNIX servers and Windows based LANS became the goal.

The ambitious goal for the Winix Network turned into developing a seamless integration of UNIX, Windows and the Internet a practical reality. The Winix product family thus consisted of four basic elements:

- Winix Network
- Winix Terminal Emulator
- Winix Application Development Toolkit
- Winix Simulation Development Toolkit, WINSIM.

May be this was an over-ambitious goal at the time? What did it actually imply?

2.1.1 Winix Network

The network intended to provide seamless integration between personal computer LANs composed of workstations running Windows and network servers running UNIX. Through Winix Network, PC users could combine the ease-of-use and broad application portfolio benefits of Windows with the power and flexibility of UNIX server functions. Winix Network should provide effective communication, data sharing, file and print services as well as software resource management across LANs and WANs through TCP/IP.

Eventually the Winix Network consisted of several basic functional modules that delivered superior connectivity and extensive communication capabilities while providing a robust, interoperable computing environment. This included simultaneous access to UNIX, MS-DOS and Windows, an MS Windows user environment with “point, click and run” interaction. The Winix Database was a relational multi-user database for structured and unstructured. Winix Mail was a robust, powerful electronic mail system providing for attachment of any binary files. Winix Conference managed the establishment of “open” and “closed” conferences on local or distributed networks, also here for appendices.

2.1.2 The Winix Terminal Emulator

The Winix Terminal Emulator provided Winix Network or standalone users with a powerful and flexible interface to access virtually any host computing environment, and provided support for synchronous and asynchronous communication protocols. The Emulator was preconfigured to support most popular terminal types and supported creation of custom terminal emulation scripts. When the Windows 3.1 was released in May 1992, Winix was already running the standard due to the close cooperation with Bill Gates and Microsoft.

2.1.3 Winix Application Development Toolkit

The initial name of this module was Mosaic and it provided Winix Network or standalone users with a robust environment for developing personal computer based applications under Microsoft Windows. Through its intuitive WYSIWYG design interface, the Winix Application Development Toolkit allowed non-programmers and application experts alike to quickly and easily create, and interactively test, sophisticated applications incorporating object-oriented techniques. Fully integrated into this Toolkit was the support for multimedia, partly through cooperation with IBM’s multimedia centre in Atlanta, USA.

In a preview of the Toolkit at both a COMDEX tradeshow in 1991 and at the MicroVision Summit conference, an application developed with the Toolkit demonstrated integrated CD-ROM inputs for interactive video that provided a simultaneous foreign language translation to English, both in text and speech.

2.1.4 Winix Simulation Development Toolkit (WINSIM)

This toolkit delivered a state-of-the-art Windows-based environment that allowed PC users with little or no programming experience to develop simulation applications. It was adapted from a previously Ministry supported product named SIMTEK dating back to 1984. The simulation toolkit still exists, now named Powersim (Powersim 2008), and further developed by Modelldata, who in 1994 got the *Rosing Award* for Powersim and the *European Academic Software Award '94*. Powersim is the only Scandinavian software product authorized as SAP Software Partner (SAP 2007).

2.1.5 Winix Services, Product Support, User Education (WSS 1992)

Winix was supported by a Scandinavian Consortium of Cooperating Companies, called Winix Support Services (WSS). Each of the Partners in the WSS had expert knowledge in different areas, and was organized in a network available to users at various levels 24 hours a day. All parts of the organization could be reached world wide through the Winix Network. The trade mark “Winix” and the figure “W” were registered in about 30 countries, e.g. Norway, USA, Japan and Germany.

2.2 Development Strategy

The development of Winix applied the same model as for Arpanet/Internet, only at a far smaller scale. The original plan for Pegasus/WINIX was simply to connect secondary schools for closer collaboration, particularly within the SPINN project (Pegasus 1988), with more than 30 different sub-projects. During the work new projects and products emerged, creating far more interest and possibilities than the original plans. Several of these new ideas turned out to be worth while following up. Pegasus also caught the interest of the Norwegian Research Council (NRC) in relation to the FUNN-project (NRC 1989).

The Winix Network was primarily developed for The Royal Norwegian Ministry of Education, Research and Church Affairs, Section for Innovation by the following centres of competence:

- 3S AB (Scandinavian System Support AB), related to the University of Linköping, Sweden
- TISIP, a Research Foundation for Project Oriented Information Technology at Trondheim University College of Engineering, Norway
- Numerica Ltd, linked to student environment at NTH, Trondheim, Norway
- ModellData Ltd, Manger, Norway, linked to University of Bergen and Stord/Haugesund University College, Stord, Norway
- Mikrosys Ltd, based near the University of Tromsø, Norway

The Pegasus/Winix project leader held a position at the University of Trondheim, Norway. The Ministry's Task Force, the “Datasekretariatet” engaged and connected the different development environments through joint development seminars and workshops, making sure that the centres had direct contact with each other. Schools within SPINN and other projects composed an idea-group (NRC 1989), making proposals for what they wanted to be developed.

2.3 Resistance

During the development period of Winix, 1987-92, critics arose from different groups. In a rather small society like the Norwegian ICT environment, it was quite natural that groups feeling left out from the development activities argued for other strategies, standards and solutions than the ones decided by the Winix development group. Some claimed that the project goals were too ambitious, particularly for educational purposes, many did not at all believe in a future for net based learning, and some argued that wrong methods or standards were chosen. Strong objections were uttered against the choice of the TCP/IP standard, while both X.25 and OSI were at hand; in reality a fight between traditional telecommunication and the new Internet environment. The OSI-model was made The Norwegian Public Standard by Royal decree of December 6, 1991, named NOSIP (Norwegian OSI Profile).

Despite envy and resistance the Winix project leader and the developers group stuck to their decisions.

3. FROM EDUCATION TO THE OPEN MARKET

3.1 Catching Attention

3.1.1 Winix in Norway and in EU

During development (1987-92) Winix was used and tested in many Norwegian educational projects, SPINN, SIRNETT etc. Until 1996/97 it was the main communication tool used in **NITOL** - *Norway-net with IT for Open Learning* (NITOL 1994), a project that proved the importance of net based learning (Haugen & Ask, 2005). Winix was also used in several EU-projects, e.g. in the pilot testing of open learning for Advance Learning Technology Professionals (ALTP) in **JITOL** (JITOL 1992), an EU DELTA project.

At the **UNESCO** conference in Paris 1992, several demos and papers presented the Norwegian strategies for IT in education, including the development and use of Winix. Top leaders at the UNESCO Headquarters in Paris made direct contacts with representatives for the Norwegian Ministry of Education, Research and Church Affairs for the use of Winix as the standard system within the organisation for educational purposes (UNESCO 1992). This was a real challenge and a tempting chance for world-wide marketing.

As a result of the positive reactions from a Paris demo of Winix in March -92, the EU DELTA-project central office in Brussels made contacts with Norwegian distributors to demonstrate Winix to all EU DELTA-projects for the possibility of applying Winix in their work. Here was another chance for reaching beyond the limits of education and national borders.

3.1.2 Interests in North America and in Other Countries

In 1991 an American company initiated a broadly based marketing campaign to realize the market potential for Winix in the North American market. These activities included presence at industry trade events like COMDEX-Spring, COMDEX-Fall, MicroVision and TELECOM'91. The activities led to a high level of international awareness of and interest in the Winix product family.

There were thousands of inquiries from potential customers and distributors, e.g. IBM, AT&T, NCR, Sun Microsystems, Digital Equipment Corporation, Unisys Corporation, Motorola and Sequent Computer. Experts expressed that it was not common for a new product to receive so much interest from the industry giants. At COMDEX-Spring 1991 Bill Gates, first spent one hour alone at the Winix stand, later on another one hour with his staff. Magazines showed great interest, e.g. *Personal Computer* "Groupware und Netzwerk", in a three pages article (PC 1992).

3.2 Commercial Challenges

Too much attention and interests without a proper organisation could easily be the great pitfall on the way to the market. A Ministry is not the right organisation for a commercial product as the Winix system now turned out to be, more than just a software product for the schools.

Early in 1991 the Winix project leader recommended for the Ministry either to sell Winix or to reorganize the whole project. Throughout 1991 work was going on to commercialise Winix. A consulting agency with broad experience on commercialising of hard- and software, J. Bakkebø, was hired to work out proposals for:

1. An enterprise structure that could manage further development and international marketing (commercialising) of Winix
2. An invitation to potential businesses, industrial partners and investors for participation in such an enterprise, including a bid to take over all commercial rights of Winix.

The agency presented their "Outline of prospect for commercialising Winix", stating that Winix is a unique software system for data communication, suggesting that a consortium be formed to take over all of Winix. The prospect should clarify owner structure, board representation and the organisation of further development, production and marketing, localisation and a financial basis. (Bakkebø 1991) The report stressed that sufficient capital of the order 100 mill NOK should be guaranteed to make sure that the enterprise would survive in case the first years should bring negative surprises in the form of delays, "a slow market", initial organisational problems etc..

In August 1991 the Ministry appointed a professional group, "Høibakkutvalget" (Høibakk 1991) to consider the commercial potential, possibilities for further development, and effects on growth in Norwegian

software industry. The group presented its report on September 13, 1991, stating that they judged the product to have a good national and international market potential, and that the product had advantages in the market that could be exploited if the actions came fast. Reference was made to an American test that was - "...unable to identify any existing products that possess the full features and benefits of the Winix Product Line."

They further expressed that the competition from internationally established software companies would be tough. In order not to lose position in relation to these competitors, it was of uttermost importance that activities related to finalising the product line, preparation for production and marketing should be continued with full efforts.

The group recommended the Ministry to contact an external agency for a special analysis of Winix, and to contact a funding agency for establishing the enterprise.

3.2.1 Special Analysis by IDC (IDC 1991) and by Market Share (Market Share 1991)

The Ministry contacted International Data Corporation (IDC). They performed the special analysis in November 1991, and concluded that: "The enormous potential for growth that occurs for Winix arises from a very lucky combination. One has found the right software solution tailored to the right hardware for computer systems of the 1990-ies." Further on it states: "And one has come far enough in development of the product to participate in the expansion. The product is in other words OK, the marketing will now decide if Winix will be part of the expected growth. We therefore believe that Winix is very well positioned to benefit from being in the particular software market that is likely to have the largest expansion in the 1990ies."

A special analysis from June 1991, by Market Share, concluded that: "The Winix concept and products are exciting and represent a new and fresh mindset within Norwegian IT. Winix will provide tools that help groups of people to effectively work together, regardless of where in the world they are."

3.2.2 American Business Group

In November 1991, the American Business Group went to Oslo with the intent to buy the Winix family of products for about 40 mill NOK, offering a royalty of 6% and free Winix-software for the Norwegian school system¹ in the future. The development should remain in Scandinavia. The Winix project leader recommended selling out. But the Ministry as the owner of the product, turned down the offer. In understanding with other ministries, it wanted to pursue its own business.

In December 1991 the American Business Group returned, now asking for a license contract with exclusive rights for sale of the Winix Products within USA and Canada, with rather promising visions for the coming years:

The Licensee warrants a minimum royalty of 4 mill US\$ for the 12 months period commencing February 21, 1992, of which US\$ 500.000 shall be paid within 6 months of the date, and US\$ 3.500.000 within 12 months. . .

The Licensee warrants that it will spend or cause to be spent a minimum of US\$ 3.1 mill, corresponding to 50% of the marketing budget set out in the present marked plan, in actual marketing expenses during 1992. The Licensee shall provide documentation of the amount spent or caused to be spent. (ABG 1992)

A business plan for the following years suggested: sales & marketing expenses in 1993 at US\$ 10.8 mill, and for 1994 US\$ 15.4 mill. Licensee's forecast for 1993 was 130 000 licenses i.e. around US\$ 190 mill and for 1994 266 000 licenses amounting to about US\$ 390 mill. Royalty were of the order 20%.

In March/April 1992 both a Swedish company and a German company wanted to enter into similar license agreements with non-exclusive rights for sale of the Winix products excluding USA, Canada, United Kingdom and Australia, with sales and marketing guarantees.

All this sounded too good to be true, and there had to be a pitfall somewhere. The hurdle was not within technology, education or business, but it turned out to be related to bureaucracy and politics.

3.3 The End

In the beginning of January 1992 the Ministry of Education founded its own company, Winix Ltd, to handle all tasks related to the Winix system. The shareholding company had a founding capital of 5 mill NOK, way off from the 100 mill NOK recommended by the consultants. The Winix Board finally had its first meeting in July 1992, about 7 months after establishment of the company, in reality the development of Winix was then already halting. There was still no managing director – or any other employees. The potential customers and license contractors were impatient and were looking in other directions. Winix Ltd actually never got up running.

With this mixture of politics and business, mostly politics, the development and support of Winix ended after a few months later, in the summer of 1992 - due to inability to deal with the challenges. The developers were told to sign a document which prevented them from further development of the Winix Network.

Despite no development or support after July 1992, Winix was in use until 1997, for instance in several EU-projects and in NITOL (Haugen & Ask, 2005). The NITOL group, established in 1994, had Winix as its backbone for 3-4 years. Gradually NITOL developed to be one of the largest providers of net based education in Norway. Winix was running very well as the major delivery system until WWW took over around 1997.

The adventures of Winix ended with a deep pitfall, without any official tales of its visions and high potential. The practical needs combined with visionary ideas and design had resulted in technical development of a package of software tools that were available just in time for the international market. Testing and presentations as well as investigations by technical and market specialists were convincing for its potential. Plans for commercialisation were politically accepted.

In order not to lose time, the potential business partners abroad initiated an aggressive and broad-based marketing campaign designed to realize the maximum marked potential for Winix, particularly on the North American market, but also in several other countries like Sweden and Germany.

These activities led to a high level of awareness of and interest in the Winix product family. It responded to a general market demand and to thousands of inquiries from potential customers and distribution partners. Serious product interest was expressed by some of the largest information users as well as by marked leading vendors. All important factors seemed to be in place, but the lack of organisation and ability to act at the final stage was a major reason for stumbling in the last hurdle.

4. CONCLUSION

The main background for starting the development of Pegasus – later Winix – in the 1980-ies was the need for a flexible and user friendly communication system between Norwegian schools, and the fact that no existing system at the time was meeting the educational requirements. The Ministry of Education and its *Task Force for IT in education* initiated development of Winix, both financially and by specifying requirements and frameworks.

Along the road new ideas and desires from the teachers and school authorities implied that extra modules were added to cover a wider range of services, e.g. tools for development of applications, tools for designing and implementing simulation software. As the functionality increased and the total package became more multi-purpose and user friendly, complexity and costs naturally also grew. This made the whole mission more vulnerable and exposed to critical evaluation.

On the other hand, this multi-purpose and flexible software system seemed to be *just-in-time* for needs and interests far outside the Norwegian school system. It caught attention, was presented and positively evaluated at large software shows, thus revealing an unexpected economic potential. How could this golden egg be handled without losing control of the product that should meet the original goals for the Pegasus/Winix development? A governmental body like a Ministry of Education was probably not the perfect organisation.

In a small environment like the Norwegian educational system there is not room for extraordinary investments and projects without meeting critics and differences in opinion. Should the Ministry sell out or should it continue spending public money to develop a product that schools wanted and that could also be an economic adventure? This was probably the turning point between success and failure.

When the decision was finally taken to create an organisational structure that could handle both the development and the marketing of Winix, it seemed half-heartedly in the political circles. In stead of quick actions and business-like behaviour, one saw delays, lack of action, lousy handling of potential customers, inability to complete the product and thus losing opportunities and capital.

Several reasons for failure at the final stage of Winix can be identified, first of all the slow bureaucratic and political process, lack of action when customers were waiting. Then the lack of sufficient capital when Winix Ltd. was finally founded, the delay in appointment of managing director as well as hiring of technical and marketing staff, lead to a quick loss of inertia. And finally but not least, internal resistance, disagreements and negative attitudes from different interest groups outside the Winix team; there were articles and campaigns to prevent a possible Winix success.

There were a lot of undeserved negative attention and media headlines around the fate of Winix. Some of it was based on industrial espionage; other arguments were based on lack of understanding or on general suspicion against public funding of the mixture of educational and business adventure. Winix ended up with being defined as a *technical* mis-investment. In reality it was a *political* or system failure in a situation where there were several ways and opportunities to put Norway on the international software market. It was a sad end to an innovative and visionary development that among other functionalities may be looked upon as a fore-runner of today's World Wide Web. Instead of success Winix ended up with a really deep pitfall.

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BRIDGING THE NATIONAL DIVIDE: USING E-LEARNING IN CITIZENSHIP EDUCATION IN ISRAEL

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ABSTRACT

One of the major social problems facing Israeli society is the cleavage between the Jewish majority and Arab minority regarding social attitudes towards each other. An Internet-based citizenship and peace education project was implemented in two Israeli high schools in order to contend with this cleavage and to enhance the development of positive attitudes of Jewish and Arab students toward each other. Based on contact theory, a four month weekly e-learning citizenship and peace education project enabled formal and informal interaction between students belonging to the two conflict groups. Results of the study indicate improvement in attitudes of both Jewish and Arab students toward each other with more significant improvement found for students belonging to the Jewish majority. The findings indicate the potential of Internet-based communications to enhance citizenship and peace education as well as positive social attitudes between members of conflict groups.

KEYWORDS

Citizenship education, Relationship, E-Learning, Jews and Arabs

1. INTRODUCTION

Many citizenship and peace education programs have been proposed to enhance democracy in the school curriculum. Among these are programs designed to bridge gaps between conflict groups and overcome cleavages between national, ethnic, religious and class groupings within society. One of the most common methods used to promote tolerance and understanding between different groups is group-contact intervention (Pettigrew & Tropp, 2006; Salomon, 2002). The underlying philosophy of such interventions is that negotiation is more productive than violence, and that it can also promote understanding and increase peaceful relationships between the conflict groups (Kelman, 1990). Most programs are designed for implementation in the school curriculum. However, despite a concerted effort to promote citizenship and peace education programs in schools, and a growing interest in such programs from government and non-government agencies, there still remains a significant lack of scientific evidence to demonstrate the effectiveness of such programs (Yablon, 2007a).

The main aim of the present study is to illuminate the issue of e-learning for the purpose of furthering citizenship and peace education in schools. An internet-based contact intervention program was designed to enhance positive relationships between Jewish and Arab high school students in the Israeli educational system.

2. INTERGROUP RELATIONS IN ISRAEL

Israeli society is split into a number of national, ethnic, socio-economic and religious sectors and groups. Because of the heterogeneity of Israeli society, the agendas of the different sectors often clash, resulting in the emergence of conflict between some or all of the groups. One of the major conflicts within Israeli society is between Israeli Jews and Israeli Arabs, two groups that are wary of each other. Relations between them are permeated with latent hostility, and this hostility is directly related to the Israeli-Arab conflict. As time has passed the gap between the two populations has grown wider and the two sectors have become increasingly

more polarized (Mossawa Center, 2006). The Jewish-Arab conflict in Israeli society has become a dominant feature of concern as recently stated by about 85% of Israeli citizens (Arian, Hermann, Atmor, Lebel & Zaban, 2008).

2.1 Jewish Majority in Israel

The State of Israel gained its independence in 1948 after the termination of the British mandate. According to the official Israeli Declaration of Independence (State of Israel, 1948) Israel was established as a Jewish and democratic state with equal rights granted to the different groups in Israeli society. The Jewish population of Israel in 1948 was 600,000 and since then, as a result of mass immigration throughout the state's existence, the Jewish sector of the Israeli population has grown to 6,700,000 (Central Bureau of Statistics, 2007). Israel has become a modern western oriented country with a well established economic, social and educational infrastructure. The per capita Jewish income in Israel approaches \$18,000 per annum and the standard of living of Israeli Jews is similar to the standard of living in an average Western European country (OECD, 2008).

2.1.1 Jewish Educational System

The Jewish educational system in Israel is highly developed and enjoys a satisfactory budget which allows for development of facilities, school-based technology, suitable teaching and learning methodologies, and varied extra-curricular programs for students at all levels in the school system (Gaziel, 1999). The level of teachers is good with almost all teachers in the educational system are in possession of a college degree and a teaching diploma. School facilities, such as classrooms, libraries, laboratories, computer rooms, and sports facilities are well developed. Although there is growing dissatisfaction within Israeli society regarding the achievement levels of Jewish students in international and national standardized achievement assessments, Jewish students maintain a higher level of attainment on these and other achievement indices than students belonging to the different minority groups (Central Bureau of Statistics, 2007). In addition, in national matriculation examinations the achievement level of Jewish students approaches the level of achievement in average Western countries (OECD, 2008).

In marked contrast to the Arab population, the Jewish population in Israel can be described as moderately satisfied with the educational outputs of schools which cater for Jewish students. Jewish parents usually cooperate with their children's schools and provide assistance and support when necessary, and are at ease with the generally successful Jewish educational system (Gaziel, 1999).

2.2 Arab Minority in Israel

Since 1948 and up until today, the Arab minority in Israel has experienced different levels of citizenships. All Arabs who remained in Israel after the 1948 war were awarded Israeli citizenship. At present about 10% of the 120 members of the Israeli Parliament (Knesset) are Arabs, 9 representing Arab parties and an Arab representing a Jewish party who serves as a minister in the Israeli government. The Israeli Arab minority enjoys equal protection under the law, has full and equal rights, Arabic is the second official language in the state (in conjunction with Hebrew) and, as all other citizens, Arabs enjoy all liberties that accompany democracy. Yet, the Arabs are still a non-assimilated minority in Israel and the policies of the successive Israeli governments are still perceived by the Arab population to be discriminatory and to perpetuate their inequality (Mossawa Center, 2006). Thus, although the successive governments of Israel have embarked on a policy of equalization to provide the Arabs with efficient government services such as education, health, and welfare as well as to narrow the social differences between the two groups (Rekhess, 2005), inequality is still evident in almost any aspect of life and, in general, Arabs live on a lower standard of living than the national average (Mossawa Center, 2006).

2.2.1 Arab Educational System

The Arab educational system is administered by the Department of Arab Education within the framework of the Israeli Ministry of Education. Katz (1998) indicated that the Israeli educational authorities have not been able to bridge the vast quality gap that exists between the Arab educational system and the educational system that caters for Jews.

The Arab educational system is characterized by a number of serious limitations which mitigate against educational achievements and success. Arab schools are typified by a significant lack of physical facilities, such as classrooms, libraries, laboratories; a significant lack of qualified teachers; a significantly high student drop-out rate; a remarkably low rate of success in the Israeli matriculation examinations which serve as a major criterion for entry into education at the university level; a significantly lower achievement rate on international and national achievement assessments; an almost total lack of extra-curricular activities offered to students by school authorities; and an almost total lack of parental interest in their children's educational future (Central Bureau of Statistics, 2007; Katz, 1998; Mossawa Center, 2006).

According to Katz (1998) these limitations are perceived by the Arab population to be part of a planned governmental policy of neglect and are viewed as an extension of grievances held against the Israeli government. Thus the Arab community feels grossly discriminated against on all fronts and most especially in the educational domain because of the inferiority of the Arab school system in comparison to schools attended by Jewish students in Israel. All this has compounded the Arabs' feelings of frustration, anger and even hostility against the majority Jewish population and against the successive Israeli governments that have consistently failed to contribute to an improvement of their educational system as well to their social and economic status. The feelings of inequality and bitterness have given rise to the fomentation of anti-Israeli Islamic fundamentalism and a general wariness of the Israeli authorities and Jewish population (Bar-Tal, 2007).

The main purpose of this study was to use Internet technology to enhance tolerance and understanding between Israeli Jewish and Arab high school students. More specifically, Internet technology was used as a platform for an educational inter-group intervention program in which the two groups interacted in cyberspace. These meetings were designed to allow the students to formally and informally interact and discuss issues such as prejudices, stereotypes, social attitudes and citizen rights of their two membership groups.

3. METHOD

3.1 Participants

The research sample comprised 40 Arab and 40 Jewish 11th grade high school students from two different schools in Israel. 37 Arab participants and 38 Jewish participants responded to the research questionnaires both before and after their participation in the project.

3.2 Instruments

A 52-item research questionnaire was specially designed to examine participants' feelings, attitudes and closeness to members of their conflict group (in their responses Jewish students referred to Arabs and Arabs students referred to Jews). The questionnaire resulted from the amalgamation of items from a number of relevant valid and reliable short questionnaires in addition to the insertion of a small number of original relevant items. A principal components analysis revealed four different factors which were used in the study: a) 'positive feelings towards conflict group' which included 12 items (Cronbach Alpha = .74) such as understanding, warmth, and empathy; b) 'negative feelings towards conflict group' which consisted of 12 items (Cronbach Alpha = .65) such as fear, anger, and disgust; c) 'social attitudes towards conflict group' made up of 16 items (Cronbach Alpha = .66) such as openness of conflict group, values of conflict group, and civic loyalty of conflict group; and d) 'closeness towards conflict group' which included 12 items (Cronbach Alpha = .82) such as to prepare for school examinations together, willingness to socialize together after school, and willingness to live in same apartment building. There was no overlap of items in the four factors.

3.3 Procedure

The research questionnaire was administered to the research sample twice during the duration of the educational project, the first administration of the questionnaire took place a week before the onset of the project and the second administration was conducted a week after the project ended.

Students from both schools participated in a four month project in which weekly sessions of Internet-based chat-room communication were used. In these sessions the students discussed their perceptions of each other as Jewish and Arab citizens in a Jewish and democratic state as well as the problems related to the solution of social and other issues characterized by inter-group conflict in Israel. The chat-room room was supported by free email correspondence between the students throughout the duration of the project. The dynamics of the online interactions ranged from cordial communications between students from the two conflict groups to the use of racially based accusations and use of inflammatory language which indicated. The communications were held on different topics, some initiated by teachers and others by students and included issues that ranged from mundane daily occurrences affecting both groups to the problems of coexistence and understanding in a divided society. The homeroom teachers of the 80 participants served as moderators of the topics dealt with in the discussions and were on call to assist participants with any needs that could arise in the chat-rooms.

4. RESULTS

In order to establish possible inter-group and intra-group differences, a number of t-tests were conducted. For possible inter-group differences both before and after the project, independent sample t-tests were carried out for the Jewish and Arab 11th graders. For the intra-group 'before-after' examinations paired sample t-tests were conducted for both Jewish and Arab students. From the results of the t-test conducted to examine possible inter-group differences before the beginning of the project, it is apparent that there are no significant differences between the two groups on all four research factors. Similar findings were evident in t-test results that examined possible differences on the research factors after participation in the project. These results suggest that both Jewish and Arab students had similar perspectives of their inter-group relationships (see Fig. No. 1).

Following the examination of the inter-group differences between Jewish and Arab students, the main research question, namely the contribution of the Internet-based citizenship and peace education project, was assessed. In a paired sample t-test conducted to measure possible changes in the Arab students' relationships with Jews, results indicated that the Arab students were more positive in their attitudes toward their Jewish counterparts on all four factors (see Fig. No.1) although significant change was indicated solely for the positive feelings factor [$t(36)=-3.26$; $p<.01$]. Similar paired sample t-tests were used to examine possible change among the Jewish students as a result of their participation in the project. Results of these t-tests indicated a positive improvement on all four research factors (see Fig. No. 1) with significant change measured for positive feelings [$t(37)=-5.29$; $p<.001$], negative feelings [$t(37)=-3.84$; $p<.001$], attitudes [$t(37)=-2.34$; $p<.05$].

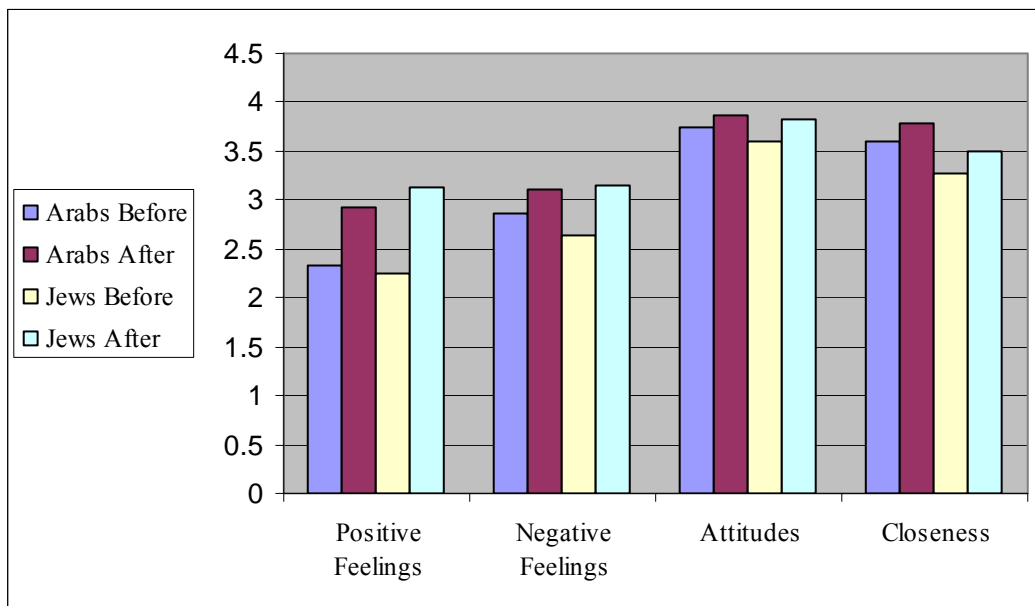


Figure 1. Jewish and Arab students' positive feelings, negative feelings, attitudes and closeness towards members of their conflict group before and after participation in the project.

5. DISCUSSION

The main goal of this study was to examine the ability of an Internet-based citizenship and peace education project to promote improved social attitudes between Jewish and Arab 11th grade high school students. It appears that, despite the deep social gap that exists between the Jewish and Arab population groups in Israeli society, a well constructed e-learning project can contribute to the enhancement of positive feelings and attitudes between the two participating groups. The major contribution of the project was to bring about a positive significant change in the social attitudes held by Jewish students towards their Arab counterparts and to shore up attitudes of Arab students towards their Jewish counterparts. Results of the statistical analyses indicate that the four month project contributed significantly to the enhancement of more positive inter-group attitudes in a complicated social situation.

It should be noticed that the positive change as a result of participation in the project was more emphasized in the group of Jewish students who demonstrated more positive feelings and attitudes towards the Arabs at the end of the project. The project also contributed to the positive feelings of Arab students toward their Jewish counterparts although the effect was more specific and limited to positive feelings. These findings should be further studied in the future. However, various scholars have already referred to such differences between minority and majority groups and have suggested that the sociopolitical reality of the particular conflict may also mitigate the structured setting of peace programs (Pettigrew, 1998), and that the two groups involved may be affected in different ways (Mugny & Perez, 1991).

The findings that indicate that the project did not enhance the feeling of closeness of Jewish and Arab students toward members of their conflict group confirm those of other studies that point to similar weaknesses of contact intervention programs (Bar-Tal, 2004). Thus it is suggested that enhancement of feelings of closeness requires more intensive intervention, more time and more opportunities for forging personal relationships than were possible within the scope of the present project (Yablon, 2007b).

6. CONCLUSION

The overall results of this project indicate the potential of Internet-based technology for the promotion of citizenship and peace education programs in which the goal is to forge positive social attitudes of members of conflict groups toward each other. The use of ICT for addressing social problems should be further considered, for example the implementation of inter-group social bonding programs within the formal school curriculum. Both technological and pedagogical considerations need to be studied so as to plan inter-group social programs based on best known practices. It is also suggested that the use of Internet-based projects to bridge gaps between conflict groups, resident in different geographical locations where any other type of communication may not be feasible, be considered.

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BRINGING THE ELDERLY INTO THE MAINSTREAM OF E-SOCIETY: THE VITAL PROJECT

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ABSTRACT

In the not-so-distant past, senior citizens often disappeared from the mainstream activities of society. In the EU project VITAL, the aim is to encourage users to go out of home, to travel, to meet other people, to participate in events; in summary to have an active and self-satisfying life that will empower aging citizens to play a full role in society, to increase their autonomy and to realize their potential and finally to improve web usability for digitally disadvantaged persons. Elderly users have special requirements with respect to user interfacing approaches and home delivered services. VITAL proposes the combination of iTV technologies, agent-based services and innovative multimodal interfaces as the best way to overcome the reluctance elderly users show to the introduction of information technology.

KEYWORDS

E-Citizenship and Inclusion, Information Systems, Intelligent Agents, Social Integration

1. INTRODUCTION

Our seniors deserve better quality of life and more integration into the mainstream of the society. Fulfilling the needs of elderly people is one of the most imperative problems in Western societies that still have no adequate answers from the responsible authorities. The progressive ageing of the population in most Western societies and the need to provide better services to a larger number of users present an important challenge to the responsible authorities because, in spite of the important increase of resources, they are unable to cope with the exponential increase of the demand. There is general consensus about the fact that the best way to improve this situation is the progressive introduction of technical aids to allow the users to achieve a more independent life by means of remote assistance. However those services still suffer from poor levels of efficiency and quality due to the intensive use of manpower and the low penetration of information technologies. But social demands are not the only reason to attend the needs of elderly users: the increased period of retired life, the continuous growing in the number of persons in this category and the improvement of their economies will make elderly users one of the leading social groups to consider when evaluating customer's purchase decisions and hence elderly users will become one of the dominant economical market sectors in the near future.

Elderly users will demand more and better services and more important they will have the necessary resources to force the attention of public and private organisations to their needs thanks to their increasing political (through their vote in elections) and economical power. The new period will be characterised by a considerable increase in the number of persons in this category (see **Figure 1**), a significant increase of the period of retired life, a general improvement of the health conditions at any age range (that nevertheless will

result in more diverse health conditions due to the physical degradation associated to the longer life expectancy) and the less homogeneous economical conditions that will vary from real situations of misery to wealthy economies with a continuum of intermediate situations. Experts and public authorities have acknowledged this trend in the recent years. It is obvious that sooner or later, social services must broaden its scope and pay attention to needs that are currently not part of ordinary assistance schemes. The problem is today's perspectives offer little space for optimism due the limited resources available and the continual increase of the demand. It is evident such a complex problem cannot have a single "magic" solution. It will be the combination of several individual efforts what will make possible to address one of the most challenging topics of modern society. We may mention some hints that could help improve the situation: anticipation (a significant amount of assistance resources are wasted because users are not prepared in advance to face their retired life), independent living (providing the users with the means to solve their own problems is the key for a significant optimisation of resources), integration into the mainstream society (special services are always expensive and inefficient, integrating assistance schemes into the general activity of the society instead of treating it as an isolated world will significantly improve the situation), massive introduction of advanced technologies (with the aim to optimize resources and address new needs).

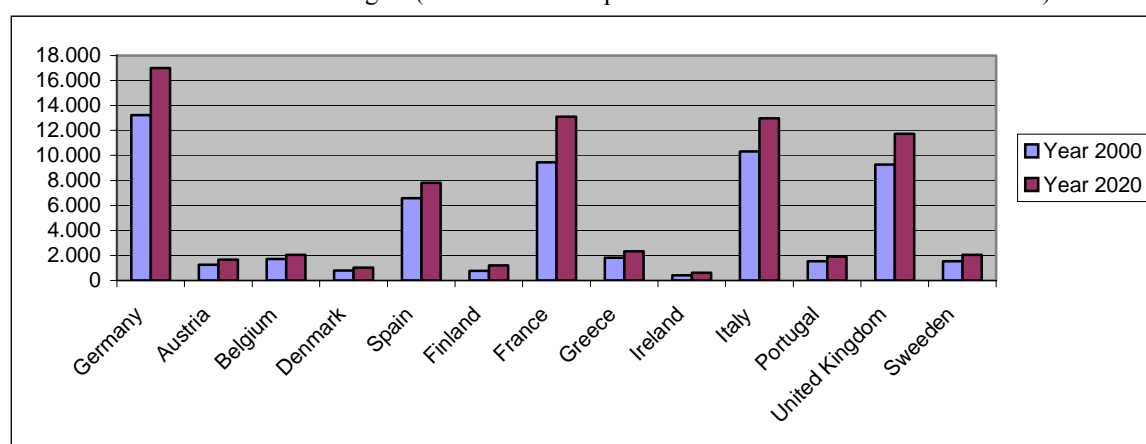


Figure 1. Projected Evolution of the Proportion of the Population aged 65 years and over in EU Member States (2000-2020). Source: Eurostat.

The European FP6 project VITAL attempts to address the needs of the elderly. The objective of the VITAL project is to develop a new services platform with the aim to significantly increase the quality of life of the average elderly user. The new platform departs from traditional assistance schemes in the sense that it is not only oriented to satisfying day to day subsistence needs but it considers also other important demands that have deserved little attention up to the moment, such as the need for: information, communication, entertainment, self-education, etc. It aims at developing natural and adaptive multimodal interfaces for the domestic TV and mobile environments that respond intelligently to speech and language, vision, gestures and other senses, interfaces able to capture user desires and deliver enriched audio-visual content while causing minimal interference with the user's activity.

The precise definition of the VITAL target user is the following: woman or man, over sixty, in reasonably good physical and mental conditions, able to operate the most common functions of a TV set using a remote controller and for certain services the user must be also able to operate simple applications on a mobile phone. The definition of the target user will contemplate the physical limitations associated with age; such as hard hearing and short sighting. The system will also consider the limitations associated with slow responsiveness, difficulty to understand complex concepts, hard learning curve and difficulty to manage too many simultaneous tasks. For that purpose the system will provide the adequate interfaces that will compensate for such physical impairments within the limits of the main requirements mentioned above: i.e. the capability to operate a remote controller and (optionally) the capability to operate a mobile phone. However, the project will not address physical or mental impairments other than those mentioned above. Such capabilities are not the focus of the project and, if required, must be incorporated as external components, provided by third parties.

The project is meant to encourage and serve users that are willing to achieve an active life inside or outside their home environment. One of the strong points of the project is the possibility to empower elderly users to take care of themselves, with the necessary assistance, and to get access to information and infrastructures that are currently banned for them. In that sense, VITAL is not just another tele-assistance platform. In fact VITAL will use already existing platforms to achieve part of its conventional objectives. VITAL may incorporate medical assistance as one of its supplied services in the future, but medical assistance is not one of the objectives of the VITAL project. VITAL does include alarm management services, but alarm management is not one of the core VITAL services. There are other good projects in these areas and VITAL will, of course, take advantage of their results; but VITAL will be more concerned with user's needs that have deserved little attention up to the moment: the need for information, the need for *inter-personal* communication, the need for improved services and the availability of new information technologies for a sector of the population for which such developments have been hitherto unavailable.

Independent living for the disabled & elderly (D&E) requires development of a suitable environment for that task. The D&E may stay at home in a known environment, close to their relatives and friends. The concept of independent living means improved access to a wide range of information and communication technologies within the home environment by means of the development of an integrated framework. For the D&E this implies improved access to information, participation in social and community activities, self-satisfying learning, leisure, etc. Support is still provided by human assistance, e.g. social workers, who are enabled to monitor the D&E.

A necessary condition to make those objectives possible and to introduce our seniors into the world of the information technology is to provide solutions to the interfacing barrier and here it is where VITAL comes into play. VITAL insight says elderly users require a single reference point in terms of assistance in all circumstances. VITAL offers a new interfacing scheme based on the concept of the personal "intelligent" assistant that must be able to dialogue with the user, interpret his demands and act in consequence. The assistant must play an active role in the life of the user; it must be always ready to respond to users request and must accomplish certain actions autonomously for the benefit of the user. The virtual assistant is not meant to substitute human assistance; on the contrary, the objective will be to complement human assistance and increase communications possibilities in order to make possible permanent connection between the users and the social careers while at the same time simplifying procedures and reducing the costs. VITAL is planned as a personalised companion for the elderly materialised in a distributed system, supported on static (TV) and mobile front-ends, where each user will have an associated personalised agent able to interact with the user and with agents from other users. Under the umbrella of this personal assistant the users have access to a complete catalogue of personalized services.

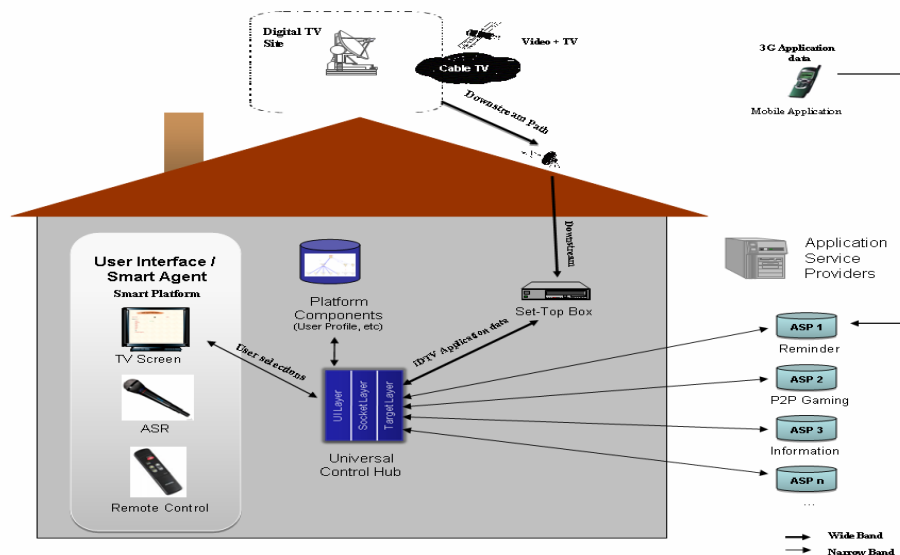


Figure 2. VITAL platform architecture

2. VITAL PLATFORM ARCHITECTURE

The overall system architecture is based on two standards: the ISO standard 24752 "Universal Remote Console" (URC), see <http://myurc.org> and <http://www.i2home.org> and the CEA 2018 "Task Model Description". Main part of the URC standard is a middleware, the Universal Control Hub, or UCH that serves as "user interface middleware" between on the one hand appliances and services (called "Targets") and on the other hand personal user interfaces implemented on some platform (called controllers). The rendition of a Target's user interface is guided by "Resources" that the Universal Control Hub (UCH) retrieves from Resource Servers on the Internet. The URC standard implements an architecture called pluggable user interfaces meaning that a user interface can--even dynamically--plug into the UCH which can serve multiple user interfaces. Important is also that the interaction in this architecture is bi-directional, that is, the user is possibly informed as the targets change their state.

The basic layout of the VITAL Services Platform is depicted in Figure 2. Elderly Users get access to the system services using Fixed or Mobile Terminals, connected to the VITAL Platform and Services by means of the communications infrastructure available at the user's site. Internal and external Service Providers provide applications which increase the quality of life for the elderly.

3. ELDERLY USERS' NEEDS

Elderly users deserve a specific assistance and care, and the design of systems aimed to increase their quality of live should be adapted to their needs. The needs of the elderly change and evolve, the need for information, the need for communication (with assistance services and other users), the need for personal advice and companionship, the need for leisure and education, etc.

Elderly users' needs and their implication for the development of a graphic user interface have been in the focus of research for several years (Echt 2002, Kurniawan & Zaphiris 2005). Changes in the visual, auditory, cognitive (memory impairment) and motor domain require a specific design. Furthermore, emotional (needs related to social contact) and leisure needs should be taken into account.

The ageing process is situated in a context where beliefs, personal values, attitudes, thoughts, etc. have their influence on people's behaviour and adaptation processes. According to Fernández-Brañas et al. (2001), the most relevant psychological conditions in the elderly are the need to be listened to, feelings of loneliness and lack of social roles, isolation, lack of adaptation and/or fear to retirement, and concern about personal loss of relatives and friends. In the other hand, social issues such as social communication needs, architectonic barriers and family dynamics must be taken into account.

Iglesias de Ussel (2001) remarks that the maintenance of social networks, and links with friends and work colleagues, reduces the dimensions of the breakage that dissociation from working environment can produce in elderly people's lives. In other cases, factors such as elderly people's associations, the search for casual contacts in the community, domestic tasks, radio, TV or religion can help coping against the feeling of loneliness generated by an eventual loss of previous social relationships. These issues have been considered when the VITAL system and the applications have been designed, with an emphasis on support for establishing social interaction among participants.

4. THE SMART AGENT

When a system's functionality gets more complex it becomes almost impossible to get a balance between simple interfaces and useful services with traditional methods. The answer is introducing intelligence into the system; trying to move, as much as possible, the initiative and decision-making from the user to the system so that interfacing requirements are reduced to a minimum. However, as the system offers more intelligent capabilities, it becomes increasingly more difficult to maintain a reasonable dialogue with the system with such a simple device as the remote. This problem is especially severe in the case of elderly people that usually have difficulties to remember things or get easily lost in complex environments. Speech is the most natural way humans communicate and VITAL offers a significant improvement in this field with the introduction of natural speech processing as the leading interfacing method between the system and the user.

The functionality required goes much further than a simple issuing of commands since the system must be able to understand user requests in her own language, translate them to a format that can be managed by computer applications, process a possibly complex request and provide the answer, again maybe in the user's own language. Speech and gesture understanding must be studied at the light of the specific circumstances of the elderly, where to the inherent difficulties of speech understanding, it must be added the frequent physical and psychological restrictions elderly users show: hard hearing, slow responsiveness, difficulty to associate concepts, etc. Another important problem worth considering is the difficulty elderly users experience to survive in today's overwhelming world of information; especially when this information soon becomes obsolete (i.e. news, TV programs, etc). Speech-processing technology is exploited to implement the possibility to search and select video documents directly from their contents.

The concepts described above imply an important innovation in the field of social assistance, but nevertheless they are still partial aspects of a more global problem. It is in the combination of such concepts, together with its cooperative implementation into a single coherent interfacing scheme, what gives value to the VITAL case. Opposite to the current trend towards ever more complex interfaces where every action, every terminal, even every technology requires a different interfacing approach, VITAL pursues a most simple and natural interfacing strategy. This paradigm bases on the notion of the *Smart Agent (SMA)* that is conceived as an intelligent interfacing entity performing in front of the user as an intermediary between the user and the technology behind. In that sense, the SMA, acting as a personal assistant, aids the user in his daily activities offering a single familiar environment no matter which terminal, infrastructure or service he desires to use. The SMA guides the user to those sources of information or services that are of most interest, based on the user's personal profile; it may provide him with news, advice, entertainment, companionship, etc.

The SMA is based on the combination of four core elements: personalisation, intelligent behaviour, anywhere / anytime capabilities and natural speech and gesture understanding. The SMA uses natural speech processing for intelligent dialogue with the system. The dialogue is improved when using personal information acquired through semi-automatic profiling procedures by means of intelligent agents technology. On the other hand, the acquisition of user personal information is facilitated by the anywhere / anytime capabilities, since the system becomes an always open window to the user. With respect to intelligent behaviour, the SMA must be intelligent enough to act according to the context and the users preferences without an explicit request from the user. Sometimes it will be very simple actions such as a birthday greeting or a reminder to take his medicine. Other times it will be more sophisticated actions such as a recommendation for a travel route or a summary of the daily news according to his preferences. The SMA must be able to detect the user environmental circumstances (identity, situation, terminal used, mode of use, etc) so that the system always present a friendly face to the user, it hides the complexity of the underlying infrastructure and adapts to the changing circumstances in order to take advantage of the best possible functionalities of the moment. Finally, the SMA must define an open architecture so that the proposed system is able to incorporate the best available technologies and most important the best available contents and services.

In the proposed architecture, one of the most important aspects is, of course, TV related activity. An "intelligent" system can easily acquire information about which programs are watched at what time and how often. This information gives clues about the preferences of the user regarding the TV programme, but is also an invaluable source of information about the general interests of the user. Obviously simply monitoring the user activity is not sufficient to achieve accurate user profiling. In order to refine the profile, avoid errors and keep an always up to date user profile, it is necessary to request user feedback at some point in time. The basic approach followed in this case is minimum user annoyance by always offering questions within context while at the same time showing some appearance of service rather than being inquisitive.

The VITAL catalogue of services includes the following facilities: communications, social interaction, entertainment, education and intelligent information, involving full integration of services for elderly users and service providers, use of appropriate terminals for each user profile (i.e. the TV or mobile), use of natural language to communicate with the machine, strong emphasis on personalisation, carefully designed interfaces and the use of existing infrastructures.

Several mechanisms, which are based on the acquired user profile and preferences, help to adapt to the user's needs:

- suggestions mechanism based on user preferences: suggestions should be offered to the user using non-disturbing procedures either at the TV or mobile terminals. The suggestions mechanism sends first a

summary of the information available and then upon user request the system will send the body of the information. Suggestions may include multimedia content. A suggestion can be followed by a question from the system in order to get user feedback about a certain topic.

- reminder mechanism. Reminders can be sent by the social assistant or automatically by the system. There are several reminder priority levels (i.e. mandatory, informative, etc). A reminder is usually followed by a confirmation question.
- connection mechanism: includes support for non-disturbing notification of communications events; requests for: videoconferencing, videoemail, peer-to-peer gaming, etc. The interface identifies the type and origin of the connection request and must give the user the option to accept, reject or postpone the connection.
- customisation of the SMA interface: includes functionalities such as the possibility to disable the connection mechanism, filter incoming suggestions, etc.

5. MULTIMODAL GUI

One of the very important features of the Vital system is its capability to basically allow for any user interfaces. One example is a user interface where the user can interact by using natural language and gestures or the combination thereof.

There are a number of strategies that can be utilized. Since the Vital platform enables for a pluggable components like new user interfaces and new targets, the concept of voice-navigated user interface is kept very generic. The Vital system consists of a number of independent applications, each of which is controlled by its unique set of gestures and voice commands.

The Multimodal Dialogue System (Schehl et al 2008) allows more intuitive control of the system by means of speech and gestures and permits a natural dialogue between man and machine. The user is able to issue combined voice commands and gestures to modify the performance of the 3D environment and to search for information related to the objects or applications in scene. The Vital system consists of a number of independent applications, each of which is controlled by its unique set of gestures, voice commands and its dialogue system.

6. VITAL APPLICATIONS FOR THE ELDERLY

The VITAL Services are designed to address real needs of the elderly population with the aim to improve their quality of life, increase their cultural level, fill in their leisure time, integrate the elderly population into mainstream society and incorporate this sector of the population into the information technology world. The applications highlight the social aspect of the project objectives, especially those services which involve two or even more users into an interaction.

6.1 Video-Conferencing

The VITAL Videoconferencing Service offers to the end users an on-line two-way point to point communication with a remote person; i.e. other Users, family, friends or social services. The elderly would find immense difficulties to communicate in the TV and mobile environments through standard text based computer tools such as email. Reading and writing long texts in the TV or mobile is inconvenient even for ordinary users: it is difficult to type; it is difficult to read, etc. Speech to text and text to speech could be an option, but those technologies are still inaccurate and they are not really needed in this context. Video is a perfect media to communicate with the family, other users or assistance services. VITAL includes several video based services such as Videoconferencing for the purpose of communication.

6.2 Peer-to-Peer Gaming

VITAL offers a number of gaming titles for the use of the elderly in the TV environment. The basic idea is the user must find somebody to play with and must share with him the experience of the game. The system includes classic games such as chess or checkers as well as less traditional ones such as role games. The user may request the aid of the “friends searcher” for this purpose. A game can be also suggested by the system automatically. The objective is to entertain and encourage social contact with other users.

6.3 Audio Books

VITAL empowers elderly users to get access to audio books from the TV interface. A simple user interface allows the elderly user to select her desired book and the system will read it for her. Reading sessions can be interrupted at any time and restarted at a later point in time from the point it was suspended. The audio contents can be downloaded dynamically from a server on demand. Books are organised in chapters respecting the usual content division in the original book. The audio books application is expected to have a significant impact on the cultural level of elderly users by making books more accessible, enjoyable and easy to read. The application also helps elderly users overcome the usual physical barrier associated to short-sighting. Reading a book on the TV also requires less effort on the part of the user. The social aspect is emphasized by the possibility of exchanging audio books generated by the users themselves, containing stories and invented narratives.

6.4 Edutainment

VITAL provides a tele-education platform that allows for the presentation of multimedia courses specifically designed for the elderly: cooking, household activities, etc. As opposed to existing practice in the iTV world, the platform is generic and will allow the presentation of multiple titles within the same application. The client application consists of a sort of multimedia blackboard that can be commanded using voice or the remote controller and supports resizable fonts according to the user preferences, text with audio feedback, etc.

The system may automatically suggest and subscribe users to the courses according to her profile. A course searcher is also included. The platform can be used to deliver all sorts of multimedia material; such as: documentaries, movies, etc. The objective of this application is to provide education for self-caring, self-learning/self- satisfaction and entertainment.

6.5 Information Service, Personal Newspaper

Elderly people are often reluctant to use new media because of technophobia. Since the VITAL system is intended to be used by this population segment, we decided to avoid the use of Web browsers, direct access to search engines (instead, the information service invokes a query on behalf of the user), and even hide the fact that the user accesses the Internet at all. The complexity of Web pages with different frames, links and advertisement is hidden and only the content related information is visible for the user. In order to accomplish transparency of the content for the elderly, we encapsulated the knowledge about the Web site we use into the project's ontology. Instead of showing a Web page, the concepts of the ontology are displayed. Using this approach “Web-surfing” is substituted by browsing through an ontology tree (Zinnikus et al. 2004), thus *improving web usability for digitally disadvantaged persons*.

The VITAL Information Service is an intelligent personal assistant, being its mission to provide improved access to information present on the Internet for people who do not have computer skills or are reluctant to use computers. The main objective is to ease the access to information present in Web by designing a very simple browsing tool and providing the means to personalize the information topics so that the long searching sessions typically required in traditional web browsers are avoided.

6.6 The Tourist Audio Guide

The Audio Guide is conceived as an innovative application for elderly tourists at their destination. The basic approach is to develop an audio guide that can be downloaded in a mobile phone. The basic idea is to perform a simulation as close as possible to a human guide in the sense that the user will receive most of the information allowing the user to hear the explanations while he focus his attention on the real thing. That last aspect is considered essential so that the user is not distracted and can focus all his attention on the real scenario while attending to the audio explanation. The Audio Guide guides the user through the visit from one interesting topic to the other by means of audio messages or navigation maps. The guide includes information relevant to the presence of facilities for the handicapped, physical conditions required for the visit, time required to complete the visit, etc.

7. CONCLUSION

In this paper, we presented the VITAL project which aims at improving the quality of life for the elderly. We described the basic assumptions, the architecture of the platform and the approach for an adaptive user interface which allows for multimodal interactions. The VITAL applications are specifically designed to serve the purpose of increasing the level of social interactions among the elderly participants.

Evaluations and tests will be performed at users' sites. Two types of testing will be performed: testing with private home users and testing in public sites such as: residences or day centres. The evaluations will be performed already during the project runtime so that applications can be adjusted to the testing experience.

ACKNOWLEDGEMENT

The work published in this paper is (partly) funded by the E.C. through the VITAL project. It does not represent the view of E.C. or the VITAL consortium, and authors are solely responsible for the paper's content.

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TOWARDS SOCIAL INTEGRATION OF SILVER WORKERS THROUGH E-LEARNING

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ABSTRACT

As a result of demographic changes and the shortage of specialists, workers beyond the traditional retirement age of 65 (the so-called silver workers) are more and more in demand. This leads to questions about their performance, learning abilities, required competences and conditions that enable them to remain productive and adaptive after 65 as well as about their social integration into a working environment that is often dominated by younger workers and by prejudices against older workers. Against this background we present some theoretical approaches which lead to useful insights into the role e-learning may play not only in updating the ICT skills and knowledge base of older workers but also setting up a tool that allows them to function as coaches for their younger colleagues. While advanced e-learning-skills are typically associated with younger workers, it may actually be the older workers for whom they have an added value beyond the obvious ones. Investing in those skills of silver workers is a sensible investment that may also contribute to a constructive working relationship and therefore provide social integration with younger colleagues.

KEYWORDS

Demographic change, silver workers, performance, e-learning, coaching, social integration

1. INTRODUCTION

1.1 Demographic Ageing

Over the next few decades, Europe faces the prospect of a serious decrease of its working population, defined as the population between 25 and 65 years old. This may have serious implications on the economic growth required to maintain its prosperity. While both internal migration and immigration may be a key factor in dealing with this problem, we focus in this paper on a specific aspect of this trend, one that may be less sensitive on the effects of migration: the need for specialists and experts required in a society that becomes increasingly a knowledge society.

A higher life expectancy and simultaneous decline in birth rates have led to population ageing in developed countries. By 2050 an increase by 13,3 percentage points (from 16,7 % in 2006 to 30 % average in the EU-27 in 2050) of the proportion of older people (65 +) among the total EU population is estimated (Eurostat 2008: 23). The demographic change doesn't just involve an increase of older people but also a decrease of younger people under 25 from 30% of the total population in 2000 to 23% in 2050. These two trends combined entail a reduction of the working age population (aged 25-64). From 2040 on the working age population will represent less than half the total population (Descy 2006: 71).

1.2 Evolution of the Recruiting Pool for Specialists

The decline of the working age population inevitably also implies an increasing shortage of specialists. While the literature is somewhat inconsistent about what constitutes a specialist, often admixing its definition with

the one of an expert, we found a reasonable consensus about the fact that a specialist has to be able to solve problems in his or her specific field (compared to an expert who has to know their solution) and that this typically requires a minimum of 10 years of consistent practice in a special field (Ericson 2000).

But not only is the demographic change responsible for the increasing shortage of specialists. Other factors, like an employment policy which stimulated early retirement for decades and thus demoted older workers to a marginal group of the employment market are focal. In 2001 the OECD-average of people working at the age of 55 to 64 was just 37,7% of that group. In response to the increasing need for (skilled) workers, this number increased to 43,5% in 2006 and 44,7% in 2007 (Eurostat 2008: 248) but even though this indicates a positive development, more than 50% of the people between 55 to 64 are as yet not employed and often considered to be 'difficult to employ.' Many in this group are, by nature of their age and careers, specialists. Often this is held against them. Especially their consistent build-up of knowledge, skills and competences in a specific field, is considered to make it very difficult for them to flexibly adapt to the sometimes rapidly changing needs on the work floor.

But changes in society also dictate an increasing demand for specialists. Globalization as well as the transition from an industrial to a knowledge society and the increasing stress of competition within international companies lead to new tasks and challenges which, in order to be solved efficiently, require specialists.

The employment of workers beyond the age of retirement may help to compensate for the increasing shortage of specialists. In order to implement such an employment strategy we must first understand performance and learning at advanced age to discuss possible supporting aspects of e-learning – also in terms of social integration of older workers – as a second step.

2. THEORETICAL INSIGHTS ABOUT PERFORMANCE AND LEARNING AT ADVANCED AGE

2.1 Mental Performance at Advanced Age

For a long time and based on American intelligence studies of the twenties and thirties performance was understood as an in deficit development with age (Jones and Conrad 1933; Miles 1934). This theory, known as the traditional shortfall model of decreasing intelligence related to advanced ageing, is refuted almost unanimously by today's gerontological, psychological and andragogical research perspectives for different reasons.

On the one hand it is based on misinterpreted data about intra personal differences from cross section studies involving individuals at different age at the same time. Thus the social initial conditions are inconsistent and therefore incomparable. Later transacted longitudinal studies – which unlike cross section studies are allowed to draw conclusions about intra personal differences – pointed out that performance is primarily related to the individual learning biography and not to the biological age (Schöpf 2007). Therefore the ability to memorize and to abstract can be maintained until high age with a better educational background (Steen and Djurfeldt 1993; Lehr and Thomae 1987; Schaie 1995; 1996).

On the other hand the traditional shortfall model rests upon an undifferentiated, general understanding of intelligence, therefore leaving different dimensions of intelligence unconsidered. With the appearance of the theory of fluid and crystallized intelligence (Horn and Cattell 1966) – emerging as a powerful model of intelligence as it relates to age – this general concept was no longer tenable. Fluid intelligence – shown as the ability to find meaning in confusion and to solve new problems – decreases from the age of 30 on, while crystallized intelligence – shown as the ability to use skills, knowledge, and past experience – remains stable as one gets older, possibly even increasing under the right circumstances (Kubinger and Jäger 2003).

In summary this differential view of intelligence paired with results of several longitudinal studies – showing an individual development of intelligence related to age – leads to today's renunciation of the shortfall model. Distinctions between age-stable and age-variable factors are more and more accepted as an alternative (Bergmann 2001; Warr 2001).

The importance of the individual learning biography at advanced age involves significant performance differences within the same age-group. The social status as well as the professional and social overall situation are crucial – also in terms of performance motivation. Loss of cognitive power is thus mostly the

consequence of mental passivity and not simply caused by age. Biological age plays a more important role on a psycho-motor level. But even though it typically leads to a general deceleration at advanced age, routine can compensate for a decreasing working speed.

Results about mental performance at advanced age and the distinction between age-stable and age-variable factors lead to important conclusions about the way older people learn. The concept of fluid vs. crystallized intelligence e.g. gives insights on how the decrease of fluid intelligence causes the age-related deceleration of learning while the age-stable crystallized component of intelligence results in a specific consistency of knowledge (Lehr 2007). The following characteristics of learning at advanced age can be pointed out: **(a)** a high learning motivation and a clear learning purpose are increasingly important with age; **(b)** the learning activity is crucial: the more learning is connected with action the better are the results. The meaning of case and practice oriented learning and a holistic learning approach gains importance; **(c)** teaching in a high speed can lead to congestions; **(d)** recent study techniques as well as the use of modern information technology and strategies of self directed learning are known only by few older people; **(e)** a clear structure of knowledge supports learning processes at advanced age: learning habits of older people were developed in times of frontal learning. This adherence to logical structures increases at advanced age; **(f)** older people learn more easily in larger chunks than in little segments: they need a picture of the whole; **(g)** learning at an advanced age is characterized by a high sensitivity to interference (Rump and Eilers 2007).

2.2 Work Performance at Advanced Age

To be distinguished from a general mental performance is a work related performance. Work performance depends strongly on past experience. Hence results of the psychometric measurement of intelligence with its isolated consideration of age-stable and age-variable factors cannot be assigned to performance related to work (Bergmann 2007: 61).

Research of characteristics of expertise points at the important connection between work performance and experience: continuous above-average work performance requires extensive expertise; typically based on at least ten years of work experience in a specific field (Ericson et al. 1993).

The concept of “work-induced ageing” justifies either an expedition or a deceleration of ageing processes depending on the working conditions (Teiger 1989; Warr 1994). Tasks with no or few learning requirements can lead to a degeneration of skills with a negative ageing trend while tasks involving advanced learning requirements can decelerate the ageing process. Similar results are emphasised by the studies of the “Institut für Wirtschaftsforschung” in Halle, which analyzed the question of work performance related to the different working-types: workers, employees and self-employed. The results point out that there is a negative ageing trend with workers and less but also with employees while no decrease of productivity can be noted with self-employed (IWH 2006).

Current knowledge about mental and work performance at advanced age has implications for our understanding of what older workers can achieve and under which circumstances they can do so. Therefore the concept of a competence model is emphasised as an alternative for the shortfall model. It points at specific competences at advanced age, different from competences at earlier life stages. The negative effects of advanced age on some cognitive tasks are not dismissed, but mechanism of compensation are emphasised. It is crucial to understand that work performance at advanced age doesn't necessarily become worse (Richenhagen 2003: 6).

2.3 Feedback Loops between Mental and Work Performance

From a systems perspective, mental performance and work performance exist in a positive feedback loop. Work performance as behaviour results from processing external input through mental operations while increased mental performance results among other elements from using the work performance as input for learning. The result is a complex learning system that uses the output of both the mental and the work processes as input. The changes that we relate to ageing are the result of the processes taking place in this complex system.

It goes without saying that biological constraints and changes – often induced by environmental factors – are an intrinsic part of this system. We experience for example a shift from right to left hemispherical dominance. It is clear that such a shift has a substantial effect on our mental competence which includes –

Goldberg follows Sternberg in this respect – not only cognition as such but also creative and social component (Goldberg 2005).

Knowledge, in general “is a nominalization which describes the processing of experiences formed by specific strategies and stored in long term memory.” (Brown-VanHoozer 1999) A specialist is capable of using this knowledge as input to a problem solving strategy.

The model of fluid intelligence vs. crystallized intelligence implies changes in the mental processes that participate in the mental/work feedback loop. In general, the behaviour of the system gradually shifts from building experience to using experience. With this shift comes a shift from a traditional ‘narrow and deep’ model of specialist knowledge to a ‘broad and shallow’ model that is more often associated with wisdom. This implies that ageing changes the nature of specialist knowledge, allowing for a more generic approach to problem solving. Similarities become more important than differences. As crystallized intelligence becomes more dominant in the mental process, the ability to recognize the similarities in the differences also increases.

Ageing makes it possible to take in larger chunks of time and space. Singular events – taking place at a specific time in a specific place – increasingly form patterns. This is crucial in anticipating the effects of actions. Not only are problems fixed but structural causes of problems are identified and remedied. The scope of the context in which problems are solved broadens. Causes that are remote in time or space are taken into consideration. Whether or not language is essential for pattern recognition, as Goldberg would have it, remains an open question. But he is absolutely right when he claims that patterns function as attractors for new information (Goldberg 2005).

3. IMPLICATIONS

3.1 Systems Thinking

In general, performance is affected by several factors. Nickols (2003) lists the following seven: *goal clarity*: a clear understanding of what needs to be achieved; *repertoire*: a set of behaviours required to attain goals despite changing circumstances and environmental disturbances; *knowledge of structures* (or patterns): an understanding of the elements that make up a situation as well as an understanding of how those elements are connected, their relationships and interdependencies; *feedback*: in this context the information needed to know if the goal is being reached or not, to decide whether corrective action must be taken, etc.; *mental models*: the internal models representing the context of the problem; *motivation*: the reasons for not only knowing how to do things but for actually wanting to do them; and *environment*: the external conditions promoting or prohibiting performance.

While the threatening shortage of specialist workers may be a reason to look into the of (re)employing silver workers beyond the traditional age of retirement, the properties of the complex social, cognitive and economic systems in which they operate may turn out to yield unexpected beneficial effects such as a better integration of short term and long term goals, a larger repertoire of possible actions, including both well tested strategies and ad hoc experimental approaches, a greater sensitivity to the effect of actions based on a better understanding of causation based on the recognition of patterns, and a wider range of mental models, including deep and narrow as well as broad and shallow ones.

In order to understand those, we must acknowledge that expertise and specialist knowledge don’t exist in a vacuum. It makes no sense to view silver workers as mere substitutes for younger workers: an organisation’s ability to integrate younger and older specialist workers has an effect on its ability to solve problems immediately as well as structurally. What is at stake is not as much the work performance of the individual silver specialist but the effect of their presence on the work performance of the whole organisation in which he or she participates. This effect may well be above and beyond the mere solution of the problem of an increasing shortage of specialists.

3.2 Macro Level: Employment Policies

As we pointed out, an employment policy focussing on the accelerated fade out of older workers to the benefit of younger ones contributed heavily to the increasing shortage of specialist workers. It should

therefore not come as a surprise that changes in the employment policy could and should contribute to changing that trend.

But from what we discussed earlier it is also clear that just turning the clock back will not suffice. Not only do we want to keep specialists active to beyond the traditional age of retirement, we also want to keep their specialist competences sharp and available until the end of their professional career. In the next section we will therefore focus on the implications on learning and training of the fact that these competences are in many respects different from those of younger colleagues and should be valued and put to use as such. But employment policies should contribute to creating a climate in which specialist and employers consider it to be meaningful to continue investing in developing competences.

Older workers themselves indicate that they experience the abrupt end of a working career as problematic. In general they would prefer a much more phased transition. Flexible, phased retirement is therefore an important tool to keep specialists active. The phasing options should include different dimensions: temporal, spatial, content related, and (less relevant here) financial. The specifics of the phasing should depend on the individual situation and be sufficiently flexible to be adapted to individual needs and wishes (Seitz 2007).

The *temporal* dimension of an employment policy includes empowerment about how much time is spend working as well as about when that time is allocated. The *spatial* dimension refers to the possibility to do more work from home, not only reducing the time, effort and cost of commuting to work, but also fading in to a situation where, after full retirement, time is spend almost exclusively at home. The *content* dimension refers to the nature of the work being performed towards the end of one's career. This could include shifts towards quality control, teaching and mentoring, etc.

In this context e-learning can help to provide the content dimension, but also realize spatial and temporal flexibility.

3.3 Micro Level: Further Education and Training

In a rapidly changing knowledge society, the value of specialist knowledge and expertise depends on the ability to keep it current. This implies that, while fluid intelligence is typically decreasing as one gets older, the ability to build new experience should be retained. Because of the constraints of the systems, this new experience should be constructed based on essentially crystallized intelligence.

It is essential for older specialists that new information is presented against the background of the patterns they constructed throughout their careers. If those patterns, which act as attractors, are not sufficiently complex and sufficiently strong and stable to include the new information, training must focus on changing the patterns rather than on the details of the new information.

But since new information cannot be avoided and since new details are not as easily remembered as they were at a younger age, appropriate teaching and learning strategies must be put in place to memorize them in order to keep the knowledgebase that is typically required for specialist work performance up to date.

This is an area where e-learning may play an essential role: Not only can appropriate software help with the memorization process, appropriate ICT-skills and search strategies as well as the increasing availability of mobile devices and online information make learning on demand or information on demand a workable assumption. So, while advanced e-learning-skills are typically associated with younger workers, it may actually be the older workers for whom they have an added value beyond the obvious ones. Investing in the ICT-skills of senior specialists before they retire – thereby not giving in to the perception that will of little or no use for them given the advances stage of their career – is therefore a sensible investment that may contribute to a constructive working relationship beyond the traditional age of retirement. This is consistent with research indicating that lifelong learning should not just focus on work-based learning but should also include formal training programmes for older workers (Paloniemi 2006). In this context the meaning of e-learning as a supporting function of social integration become apparent.

3.4 The Value of e-learning

3.4.1 The Value of e-learning for Performance

We now want to make the case for the importance of e-learning as a valuable tool to support and develop performance and learning and therefore also as a factor in social integration. E-learning provides a context to implement the general ICT-skills required to keep specialists active beyond traditional retirement. But from a psychological-pedagogical perspective – provided certain conditions are fulfilled – e-learning programmes can also perfectly meet the requirements, that are important for successful learning. That holds especially for learning at advanced age. By using e-learning programmes the learner can often himself or herself choose the order in which the content is presented.. That leads to different possibilities to structure the information in terms of its logical-temporal trajectory. The learner can therefore also decide on his or her individual learning speed. E-learning imposes a substantial amount of involvement on the learner, which can eventually lead to excessive demand (Stangl 1997). Regarding the characteristics of learning at advanced age, such as the importance of the learning activity and of a clear structure of knowledge – the potential of e-learning to meet these requirements become obvious. .

But e-learning doesn't necessarily lead to success. Certain conditions must be met, especially when dealing with e-learning for older specialists. Going back to Nickols' seven factors (Nickols 2003) which influence performance, this concept can actually be read as a program for a successful e-learning project for older specialist workers:

1. **goal clarity**: we pointed out how older learners need a clear idea of where they are heading;
2. **repertoire**: participating in an e-learning programme induces a set of behaviours required to attain goals in changing circumstances;
3. **knowledge of structures** (or patterns): the understanding of the elements that make up a situation as well as the understanding of how those elements are connected, their relationships and interdependencies is crucial in a successful e-learning programme;
4. **feedback**: an e-learning programme must provide the information needed to know if the goal is being reached or not, to decide whether corrective action must be taken, etc.;
5. **mental models**: a successful e-learning programme must be based on a set of internal models representing the context of the problem;
6. **motivation**: the reasons for not only knowing how to do things but for actually wanting to do them must be part of the e-learning programme;
7. **environment**: the external conditions promoting or prohibiting performance. These include the special and temporal as well as the content-dimension of the transition towards becoming a silver worker.

This implies that e-learning programmes, because of their specific characteristics, are excellent tools to train older workers taking into account their specific needs but also to implement their role in an organisation.

3.4.2 The Value of e-learning for Social Integration

As we mentioned before the use of e-learning as well as advanced ICT-skills may also play an important role for the older workers' social integration into a work environment that is often dominated by younger workers.

Taking into account that there are prejudices against older workers and their performance as well as against their possibly outdated work methods the following aspects regarding e-learning are important.

On the one hand e-learning can contribute to maintain and train the declining part of mental performance (e.g. memorization to keep the knowledge base up to date) and therefore has a positive effect on the silver workers' work performance. That leads to more social acceptance and valuation through their younger colleagues and avoids social isolation and frustration.

On the other hand e-learning and the use of ICT-skills need to be understood as a communication tool within an organisation. Speaking the same "language" as their younger colleagues plays such an important role for a fruitful and equal working climate. Therefore e-learning provides a meeting ground for young and old and supports the bidirectional exchange of knowledge and experience.

But another social aspect may be crucial. Older workers don't like to be treated differently than their younger colleagues although some of the results we mentioned earlier indicate that an appropriate didactic approach is called for (e.g. Geldermann 2007). E-learning can help to solve this problem by allowing

different learning paths and learning curves for different target groups. Treating them differently is then not only at the core of the program but it also less obvious to the participants.

4. CONCLUSION

Systems thinking provides a background against which we can understand how the presence of silver workers in an organisation may have an effect that stretches way beyond merely solving the increasing shortage of specialists. This effect can exist precisely because of the qualitative difference between younger and older workers. This difference should therefore not be viewed in terms of deteriorating competences but rather in terms of changing competences.

The age-related decrease of fluid intelligence and the stable crystallized component of intelligence create a context in which teaching strategies and learning techniques take the age of the participants into consideration. Doing so is important, because further education and training of silver specialists are essential in creating value for the organisation in which they perform.

Employers who want to keep their specialist employees performing up to the traditional age of retirement (and, increasingly, also beyond that age) need to realise that in order to do so they not only need to focus on silver specialists but also create an environment in which all their workers can build the individual learning biography required for lifelong performance based on lifelong learning. With governments they need to create the educational setting that creates a climate for lifelong learning starting way before the typical age of employment and continuing beyond traditional retirement. The training of silver specialist as trainers is an essential element in such a programme.

E-learning programmes, because of their specific nature, provide an excellent context to make that happen. Not only can they be used to train older specialist themselves, they can and should also be used by older specialists to train and interact with younger co-workers. An e-learning programme, properly conceived to also take into account the specific needs of older learners, may provide the perfect meeting ground of young and old.

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CONCEPTUAL DESIGN MODEL OF REALITY LEARNING MEDIA (RLM)

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ABSTRACT

This paper describes about an ongoing research that proposes a type of eLearning material (eLM) which is named as Reality Learning Media (RLM). The research is initiated by a scenario in which higher learning institutions (HLI) are moving towards implementing eLearning, but the content are not provided for student access. This paper describes the methods of deriving the model, inclusive of three-step approach; comparing existing models, developing models, and validating models. This paper contains a number of findings; structural components (SC) and model of RLM, content composition components (CCC) and model of RLM, and a prototype of RLM. As the conclusion, this paper outlines future plan of the study.

KEYWORDS

RLM, reality learning, conceptual design model.

1. INTRODUCTION

This study focuses on the eLearning materials (eLM) in eLearning environment. To be more specific, this study concerns about making eLM entertaining and invoking fun. Previously, Ariffin and Norshuhada (2008) found that the existing coursewares were usable. They were provided by the Educational Technology Division, Ministry of Education Malaysia (BTP, KPM) for use in all public secondary schools in Malaysia. However, Ariffin and Norshuhada (2008) also found that the coursewares were not entertaining and not invoking fun when viewing. This ended up with dissatisfaction among learners upon the courseware. As a result, the project did not show good return when the coursewares are no longer used in many schools (Konting et al., 2003).

In conjunction, design of a system does not invoke fun merely because it incorporates colors and animations, sound and music, or graphical fantasy contents. Also, distractions may surprise audiences, may capture attention, but are annoying and not fun. It is believed that the possibility of fun arises when one is both aroused and intrigued, and at the same time recognized an intention to communicate through a design.

Studying entertaining eLM leads to understanding what makes learners feel entertained. So, the entertainment technology should be studied to discover factors leading to feeling entertained. This study then decided to survey on preferences upon TV programmes because TV is a famous entertainment, owned in most households. It is sufficient to consider investigating the preferences because currently there are two formats of TV programmes; i.e. reality and non-reality. Furthermore it is said that viewers prefer to watch reality TV more than non-reality. There are seven categories of reality TV (Meisel, 1998): dating show, talk show, hoaxes, elimination/game show, hidden camera, documentary-style, and self-improvement/makeover.

To really observe viewers' preferences, a survey was carried out. The results showed that reality TV were preferred for viewing more than non-reality (Ariffin & Norshuhada, 2008). Favorite reality programmes among adults include Explorace, Anita, and Akademi Fantasia, while Tom Tom Bak, Gerak Geri Gasing, and Haiwan Teladan were among preferences for children. Summary of results can be seen in Figure 1.

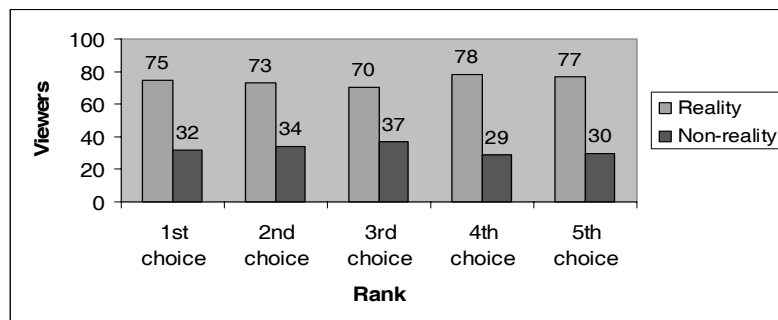


Figure 1. Difference on viewing preferences between reality and non-reality TV programmes

In addition, among favorite reasons to view reality shows from respondents is “...it is frequently seen in reality shows that mistakes may come from speeches and actions, while the environment might cause unintended interferences. Feedbacks always come from viewers and actors (in and out of frame). Those are natural reactions and always happen, in fact they also convey information...”.

Considering the disadvantages of courseware as described above, and current trends in TV viewing, this study proposes another type of eLM. The concepts are adapted from the reality TV, where the contents are not cut. This means natural elements such as mistakes, spontaneous jokes, and unintended interferences are included and presented to learners. In addition, this study proposes these elements as part of the contents.

It is suggested that in developing a proposed concept, the conceptual model should first be laid out. This conceptual model treats to state and present the ideas effectively. The proposed RLM conceptual design model gives particular attention to delivering contents which serves to entertain learners when learning. This triggers questions as listed below:

- How to ensure that eLM is perceived entertaining and invoking fun by learners?
- How to enable instructors in HLI especially the non-technically-skilled to produce eLM that are considered fun and entertaining?

This research work expects to answer the above questions at the end of the study. Based on the questions above, this paper sets the **objective**; that is to propose a conceptual design model for RLM. To achieve the objective, a systematic research approach as described in the next subsection was performed.

1.1 Research Methods

Three steps were involved in coming out with the conceptual design model of RLM. Figure 2 depicts the process; left boxes are steps and right boxes contain activities.

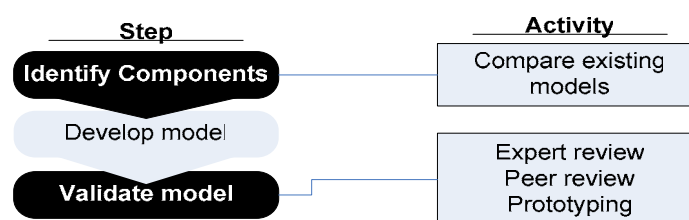


Figure 2. Summary of research steps

First, this study identifies components for RLM. The components should be mapping with components in the existing eLM. So, models of existing eLM were compared. This study makes use of real products as models for comparison. It involved courseware, video, and ETP. They were selected on the basis that RLM is a type of video, so only models with rich media are considered.

Then, the components were formed as a diagram to represent a high level concept of RLM, which serves as the conceptual design model. Finally the model was validated in three ways; expert review, peer review in conferences, and translating the model into prototypes.

2. IDENTIFYING COMPONENTS AND DEVELOPING MODELS

It involved fifteen samples (i.e. five for each courseware, video and ETP) covering various topics including sciences, mathematics, nature, sports, and Religious. Table 1 lists all models. These topics cover both formal and informal lessons, and have been decided by taking the lists of ETP produced by Bahagian Teknologi Pendidikan, Kementerian Pelajaran Malaysia (BTP, KPM) as the basis.

Table 1. Selected eLM as models for comparison

Courseware	C1: Biology – Form 4 C2: Mathematics C3: Kesan haba terhadap jirim C4: Matematik Tingkatan 1 – Pepejal dan isipadu C5: Kesan rumah hijau
Video	V1: English for business management programme1 (Publisher: Guild Learning International) V2: Carbon Monoxide (Publisher: Safety Projects International Inc.) V3: Using Media in Learning: Still Pictures & Photography (Publisher: Learning Resources Center, Virginia) V4: Perjalanan Hidup Manusia (Publisher: Pustaka Al-Manar) V5: How To Play Squash (Publisher: Robert Page)
Educational TV Program	ETP1: Pengaruh Cuaca Dan Iklim (Channel: TV Pendidikan) ETP2: Snips and Snaps (Channel: TV Pendidikan) ETP3: Science of The Deep: Aquarius – Living Beneath The Sea (Channel: ASTRO – Learning (Discovery Science)) ETP4: 20 Steps to Better Management (Channel: ASTRO – Family (TVIQ)) ETP5: Megamaths (Channel: ASTRO – Family (TVIQ))

The conceptual design model is defined separately in terms of SC and CCC. SC and CCC are described separately in subsequent sections.

2.1 Structural Components

First, each sample for all categories was analyzed. It started with the courseware. To ensure that the selected coursewares are highly reliable in terms of their standards as well as accessibility (i.e. widely distributed and owned by all schools), they were selected from items produced by the BTP, KPM. Then, video were compared and finally ETP were analyzed (see Table 2).

Table 2. Structural components of courseware

Section	Component	Courseware (C)					Video (V)					Edu. TV Prog. (E)				
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Opening section	Title	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
	Verso	/	/	/	/	/	/	/			/	/	/	/	/	/
	Developing team			/	/	/	/		/		/	/	/	/	/	/
Content section	Objective of course	/	/	/	/				/	/	/	/	/		/	
	Section separators	/	/	/	/	/	/	/	/		/	/	/	/	/	/
Closing section	Debriefing	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
	Thanking remarks								/		/			/	/	/
	Acknowledgements			/	/	/			/		/	/	/	/	/	/

Note: C1 – courseware 1; V1 – video 1; E1 – ETP 1

/ - means found as contained

It is now appropriate to summarize the components to represent each category. The classification of components follows the rules in Figure 3. The summary of SC is provided in Table 3.

<u>Cat</u>	<u>Description</u>	<u>Condition</u> (where statement)
<u>A</u>	All samples apply.	<u>All</u> samples apply.
<u>M</u>	Majority of samples apply.	There are <u>four</u> samples applying.
<u>F</u>	Few samples apply.	There are between <u>one</u> to <u>three</u> samples applying.
<u>X</u>	Not applied in any sample.	There is <u>no</u> sample applying.

Figure 3. Categories of components

Table 3. Structural components of eLM

Section	Component	C	V	E
Opening section	Title	<u>A</u>	<u>A</u>	<u>A</u>
	Verso	<u>A</u>	<u>F</u>	<u>A</u>
	Developing team	<u>F</u>	<u>F</u>	<u>A</u>
Content section	Objective of course	<u>M</u>	<u>F</u>	<u>F</u>
	Section separators	<u>A</u>	<u>M</u>	<u>A</u>
Closing section	Debriefing	<u>A</u>	<u>A</u>	<u>A</u>
	Thanking remarks	<u>X</u>	<u>F</u>	<u>F</u>
	Acknowledgements	<u>F</u>	<u>F</u>	<u>A</u>

Table 4. Proposed structural components of RLM

Section	Component	RLM
Opening section	Title	☉
	Verso	☉
	Developing team	☉
Content section	Objective of course	☉
	Section separators	☉
Closing section	Debriefing	☉
	Thanking remarks	☺
	Acknowledgements	☉

☉ compulsory

☺ recommended

As stated earlier, the components of existing eLM were used as a guide to propose the components of RLM. Accordingly, from the summary of SC in Table 3, a list of SC of RLM was outlined. The conditions for determining compulsory and recommended components were as stated in Figure 4. Based on the rules, the SC of RLM was proposed and is provided in Table 4.

The component is compulsory (☉) when there is any A OR there is at least one M with no X in the row.

The component is recommended (☺) when there is no M, but only F and X in the row.

Figure 4. Conditions for classification

The components in Table 4 are commonly contained in the eLM. It can be seen that some of components are contained in all eLM, but some are contained in at least one type of eLM, in which these fit the conditions. From the proposed components in Table 4, the model for RLM structure was obtained, and is illustrated as in Figure 5.

From the above definition, **opening section** should contain information about the development team. This is particularly important because in promoting user experience, branding has been tackled as one of the strategies (Rubinoff, 2004). So, the developing team can reflect the brand of the RLM. Figure 6 states developing team as one of the components to show that the information is sufficient for inclusion, but that element could always be in the opening or closing section, such as in the thanking remarks. This study changes the content section in Table 6 with *reality content section* to reflect the nature and content type to deliver. In the **reality content section**, the separators between sections should not be necessarily in slide-based form, but they could also be created using speeches (speech-based). Having described the SC, it is now appropriate to discuss about the CCC.

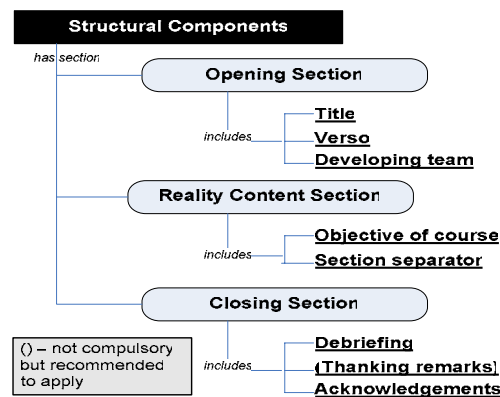


Figure 5. Structural components of RLM

2.2 Content Composition Components

The identical process with identifying SC started with analyzing the components for courseware, followed with video, and finally the ETP. Table 7 lists the components and groups the components into two main categories namely pedagogical strategies and human entities; the pedagogical strategies part is further broken into four sub-categories i.e. styles of presentation, content delivery strategies, styles of flow, and media elements.

Table 7. Content composition components of courseware

		Components	Courseware (C)					Video (V)					Edu. TV Prog. (E)				
			1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Pedagogical Strategies	Media elements	Audio	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
		Visual:															
		Images	/	/		/	/	/	/	/		/	/	/	/	/	/
		Real objects			/	/		/	/	/	/	/	/	/	/	/	/
		Texts	/	/	/	/	/	/	/	/		/	/	/	/	/	/
		Graphics	/	/		/		/	/	/		/	/	/	/	/	/
		Animations	/	/	/										/	/	/
		Simulations	/	/	/					/		/	/		/		/
	Styles of presentation	Lecturing								/	/						
		Instruction-based		/										/			
		Documentary					/		/				/		/		/
		Demonstration	/	/	/	/		/				/		/		/	/
	Content delivery strategies	Briefing	/	/								/	/	/	/	/	/
		Objectives	/	/	/	/				/		/	/	/		/	
		Content	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
		Closing	/	/				/	/		/	/	/	/	/	/	/
	Styles of flow	Separated	/	/	/	/	/	/	/	/		/	/	/	/	/	/
		Non-separated									/				/		
Human entities	Actor:																
	Instructor		/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
	Learner							/				/		/			/
	Audience		/	/	/	/	/	/	/	/	/	/	/	/	/	/	/

The details of all samples as tabulated in Tables 7 were summarized to represent the CCC of each category. Based on the same rules as in classifying the SC (see Figure 4), the CCC of each category is provided in Table 8.

Table 8. Content composition components of eLM

		Component	C	V	E
Pedagogical strategies	Media elements	Audio	<u>A</u>	<u>A</u>	<u>A</u>
		Images	<u>M</u>	<u>M</u>	<u>A</u>
		Real objects	<u>F</u>	<u>A</u>	<u>A</u>
		Texts	<u>A</u>	<u>M</u>	<u>A</u>
		Graphics	<u>F</u>	<u>M</u>	<u>A</u>
		Animations	<u>F</u>	<u>X</u>	<u>F</u>
		Simulations	<u>F</u>	<u>F</u>	<u>F</u>
	Styles of presentation	Lecturing	<u>X</u>	<u>F</u>	<u>X</u>
		Instruction-based	<u>X</u>	<u>X</u>	<u>F</u>
		Documentary	<u>F</u>	<u>F</u>	<u>F</u>
		Demonstration	<u>M</u>	<u>F</u>	<u>F</u>
	Content delivery strategies	Briefing	<u>F</u>	<u>F</u>	<u>A</u>
		Objectives	<u>M</u>	<u>F</u>	<u>F</u>
		Content	<u>A</u>	<u>A</u>	<u>A</u>
		Closing	<u>F</u>	<u>M</u>	<u>A</u>
	Styles of flow	Separated	<u>A</u>	<u>F</u>	<u>A</u>
		Non-separated	<u>X</u>	<u>F</u>	<u>F</u>
	Human entities	Actor	<u>A</u>	<u>A</u>	<u>A</u>
		Audience	<u>A</u>	<u>A</u>	<u>A</u>

Table 9. RLM CCC based on the analyzed eLM

		Component	RLM
Pedagogical strategies	Media elements	Audio	☺
		Images	☺
		Real objects	☺
		Texts	☺
		Graphics	☺
		Animations	☺
		Simulations	☺
	Styles of presentation	Lecturing	☺ [#]
		Instruction-based	☺ [#]
		Documentary	☺ [#]
		Demonstration	☺ [#]
	Content delivery strategies	Briefing	☺
		Objectives	☺
		Content	☺
		Closing	☺
	Styles of flow	Separated	☺ [#]
		Non-separated	☺ [#]
	Human entities	Actor	☺ [#]
		Audience	☺ [#]

The CCC were derived from the summary in Table 8, and provided in Table 9 based on the same conditions as in the SC (see Figure 5). RLM maintains the components of existing eLM (i.e. listed in Table 9) because they were found as important, and have been reported by many researchers as leading to positive effects in terms of reducing cognitive load (Norhayati, 1999), catching learners' attention (Norman, 1988), and addressing pedagogical issues (Brown, 1997). In addition, RLM extends the content part to ensure that the learning contents are entertaining and arousing, causing laughter, and fun to use.

The findings of reality TV survey discussed in Section 1 were considered when extending the components in Table 9. Based on those arguments, Table 10 lists the extended CCC of RLM to include the unplanned reality content. The unplanned reality content components (together with its breakdowns) are underlined. This study proposes that the term entertaining reflects to these components.

Table 10. Proposed RLM content composition components

		Component	RLM
Pedagogical strategies	Media elements	Audio	☺
		Images	☺
		Real objects	☺
		Texts	☺
		Graphics	☺
		Animations	☺
		Simulations	☺
	Styles of presentation	Lecturing	☺ [#]
		Instruction-based	☺ [#]

		Documentary	☺ #
		Demonstration	☹ #
	Content delivery strategies	Briefing	☹
		Objectives	☹
		Reality content	☹
		Planned	☹
		<u>Unplanned</u>	☹
		<u>Mistakes</u>	☹
		<u>Interferences</u>	☹
		<u>feedbacks</u>	☹
		Formative assessment	☹
		Closing	☹
	Styles of flow	Separated	☹ #
		Non-separated	☺ #
	Human entities	Actor	☹ #
		Audience/viewers	☹ #

The components listed in Table 10 were represented as the model for content composition, and is provided in Figure 7. Ariffin and Norshuhada (2009) explain every component in the model in detail.

3. VALIDATING MODELS

The instructional design expert who verified the models has obtained a PhD, where his research was on instructional design topic. In addition, his current research interest is also in instructional design. His expertise capital makes the results unbiased. The expert agreed with the instructional elements in the models.

At the same time the models were also sent to video practitioner for review. The video practitioner has developed a number of video projects including for implementation at National levels and viewing on TV. From his past experience, he found that the models are understandable and possible to follow. Based on the model, a prototype of RLM has been developed. Samples of shot in the prototype are depicted in Figure 6.

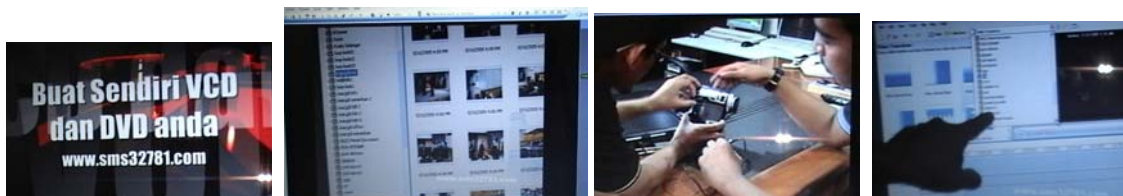


Figure 6. Shots in the prototype

The prototype in Figure 8 contains contents on the process of making VCD. Learners are taught step-by-step from start to finish.

Another source of reviewing is through conference. The rough concept and model have been discussed in an International Educational Technology Convention (Ariffin & Norshuhada, 2007). Experts and peers were agreed that the models extend the learning process, with some suggestions for refinement. In addition, it is an intention for this paper to discuss about the finalized models in Figures 5 and 7.

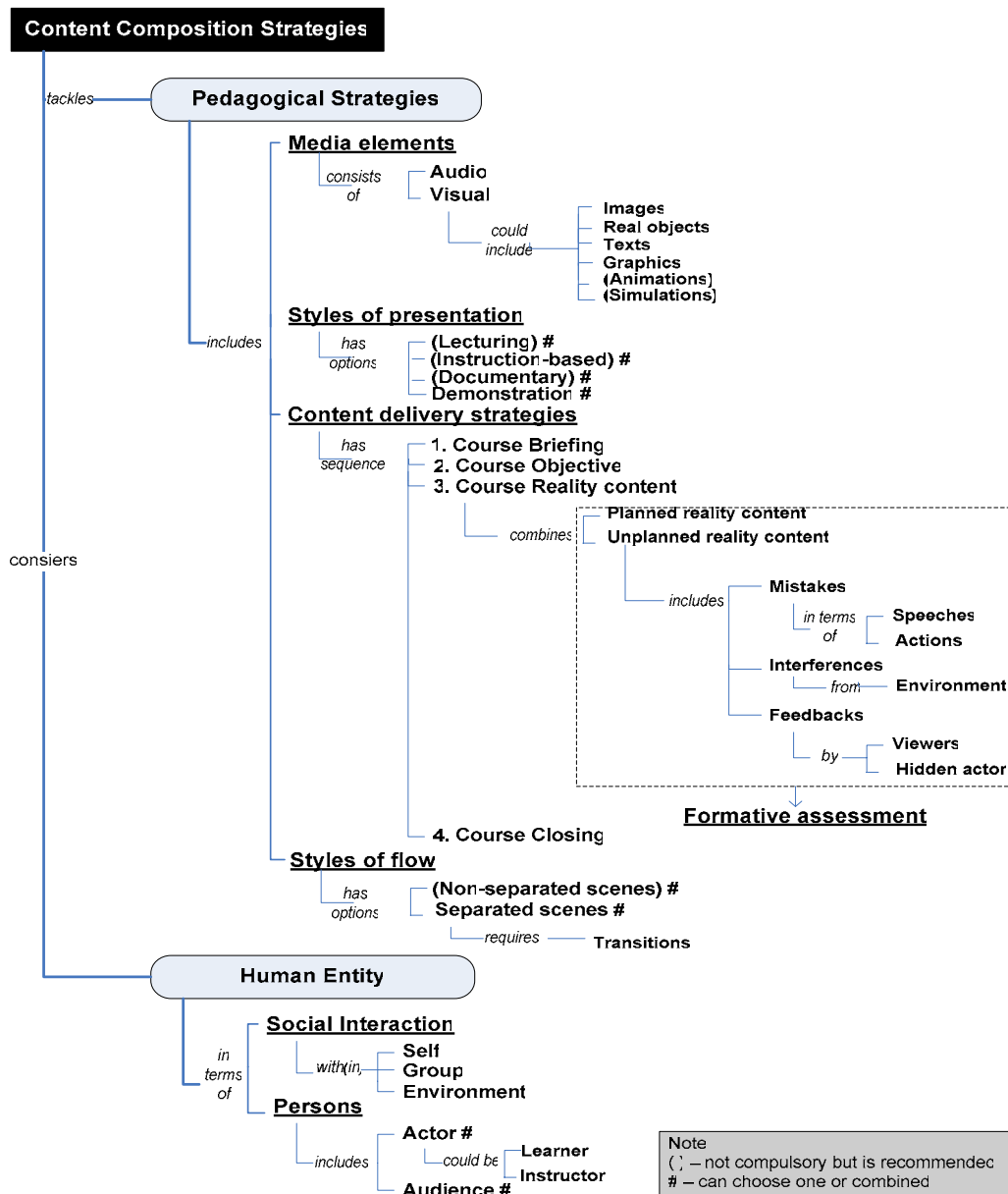


Figure 7. Proposed conceptual model for content composition of RLM

4. CONCLUSION

RLM is proposed as a type of eLM, in which the models have been reviewed and polished. The RLM could be used in teaching at HLI partly as efforts discussed in Chandra (2007). However, there are some dissimilarities, and will be discussed in other article. Next, this research will test the RLM with the real users to investigate whether RLM with components listed in Table 12 is entertaining learners and invoking fun because it has been argued that fun is important in fostering learning, such as discussed by Marcus (2007). Besides, testing of its effectiveness will be within consideration. In addition, comparisons between models in this paper and the existing model (i.e. courseware and video) will be carried out, such as using heuristics (Lera & Garreta-Domingo, 2007) and focus group (Poels, Kort, & Ijsselstein, 2007).

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VISUAL SIMULATION OF CONSTRUCTION ACTIVITY SUPPORTED ON VR MODELS: E-LEARNING TOOLS

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ABSTRACT

This paper describes the application of virtual reality technology to the development of teaching models related to the construction activity and to the design of roofs. The models, showing construction processes, allow the visualization of the physical progression of the work following a planned construction sequence, the observation of details of the form of every component of the works and carry the study of the type and method of operation of the equipment applied in the construction. The roof model supports student to draw up plan drawings of roofs and the correspondent 3D model, tasks which relies on an understanding of the three-dimensional nature of the respective constructive process. The models present distinct advantage as educational aids in first-degree courses in Civil Engineering.

The main objective of the practical application of the models is to support class-based learning and in addition, the students can interact with the models using there own PC. The models are adequate to be used in distance training based on *e-learning* platform technology. The involvement of virtual reality techniques in the development of educational applications brings new perspectives to Engineering education.

KEYWORDS

Didactic models, virtual reality, engineering education, educational multimedia, e-Learning tool.

1. INTRODUCTION

At present, in carrying out a project, the use of new computer technologies, in particular, graphics systems and especially those relating to **three-dimensional modeling** (3D), makes a very positive contribution to improving the transmission of rigorously correct technical information and, in general, to the understanding of spatial configurations in their environment. This means of expression surpasses a drawing or a diagram. These systems support the creation of models defined in three dimensions, providing a distinct type of plane projection, without being limited as to localization, viewpoint, orientation or distance from the observation point. The understanding of the real form is, obviously, rather more intuitive.

In addition, **virtual reality technology** (VR) has also been applied as a complement to 3D modeling, leading to better communication between the various stakeholders in the process, whether in training or in professional practice. This task is particularly relevant to the presentation of processes which are defined through sequential stages as generally is the case in the learning of new curricular subjects. In professional contexts, note the contribution in Architecture/Engineering, to support for conception (Petzold, 2007), presenting the plan (Khanzode, 2007) or following the progress of construction (Leinonen, 2003). The application of VR in training, both surgical (Perez, 2008) and laboratory (Bell, 2004), are references for models used in professional education.

A school of engineering can be reasonably expected to constantly update computational resources which are in frequent use in the professions, resources which must be introduced into the training of the student, leading to their adaptation for curricula in these disciplines. In Technical Drawing the adaptation has been gradual accompanying the appearance of new graphics systems/products supporting plan drawing and modeling. At present, the subject Computer Assisted Drawing (Integrated Master in Civil Engineering, at the Technical University of Lisbon) is contemplating the introduction a module on teaching a graphic system supporting Engineering activities. Its introduction is complemented by basic notions of Computer Graphics.

Besides this constant updating of training in the new graphic resources available to Engineering professions, and in widespread and frequent use, the School should also adapt its teaching activities to the **new tools of visual communication**. This text describes the application of new 3D geometric modeling and virtual reality technologies in the development of three educational models in Civil Engineering domain. This kind of application is an important interactive didactic document to be implemented in *e-learning* platforms.

2. VIRTUAL REALITY MODELS IN EDUCATION

The aim of the practical application of the virtual models is to provide support in Civil Engineering education namely in those disciplines relating to drawing, bridges and construction process both in classroom-based education and in distance learning based on *e-learning* technology.

Specialist in construction processes and bridge design were consulted and involved in the execution of the construction models in order to obtain efficient and accurate didactic applications. In construction, the selected examples are two elementary situations of works: an external wall is a basic component of a building (Sampaio, 2007) and the cantilever method of bridge deck construction is applied frequently (Sampaio, 2004). The roof model supports the explanation of subject matter pertaining to elevation projection representations applied to the design of roofs (Sampaio, 2008). The model presents the method of designing a roof using the usual graphic elements of plan drawing but displaying them in their three-dimensional form. In this way the model supports the learning of the methodology pertaining to the practical aspects in drawing roofs.

The **pedagogic aspect** and the **technical knowledge** are presented on the selection of the quantity and type of elements to show in each virtual model, on the sequence of exhibition to follow, on the relationship established between the components of both type of construction, on the degree of geometric details needed to present and on the technical information that must go with each constructive step. Further details complement, in a positive way, the educational applications bringing to them more utility and efficiency. Namely, the model of the wall shows the information concerning construction activity of interest for students corresponding to the geometric stage displayed in each moment and the bridge construction model shows particularly the movement of the equipment in operation during the progression. The roof model shows in animation the intersection between two simple roofs in order to explain how to define a more complex roof.

The virtual model can be manipulated interactively allowing the teacher or student to monitor the physical evolution of the work and the construction activities inherent in its progression. This type of model allows the participant to interact in an intuitive manner with the simulated environment, to repeat the sequence or task until the desired level of proficiency or skill has been achieved and to perform in a safe environment. Therefore, this new concept of VR technology applied to didactic models brings new perspectives to the teaching of subjects in the area of Civil Engineering.

3. MODEL OF THE WALL

The virtual model of a masonry cavity wall, one of the basic components of a standard construction, enables the visual simulation of its construction. To enable the visual simulation of the construction of the wall, the geometric model generated is composed of a set of elements, each representing one component of the construction. The selection of elements and the degree of detail of the 3D model configuration of each component had the support of teachers and specialist in construction. The definition of the 3D model of an exterior wall of a conventional building comprises the structural elements (foundations, columns and beams, Figure 1), the vertical filler panels and two bay elements (door and window, Figure 1).

Using the EON Reality system (EON, 2007), a system of virtual reality technologies, specific properties were applied to the model of the wall in order to obtain a virtual environment. Through direct interaction with the model, it is possible both to monitor the progress of the construction process of the wall and to access information relating to each element, namely, its composition and the phase of execution or assembly of the actual work, and compare it with the planned schedule (Figure 2).

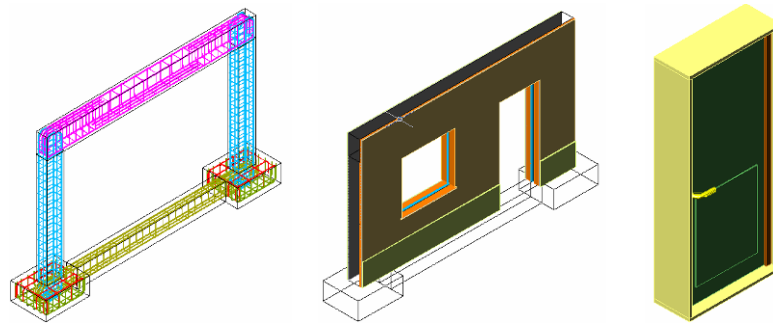


Figure 1. 3D models of the wall components

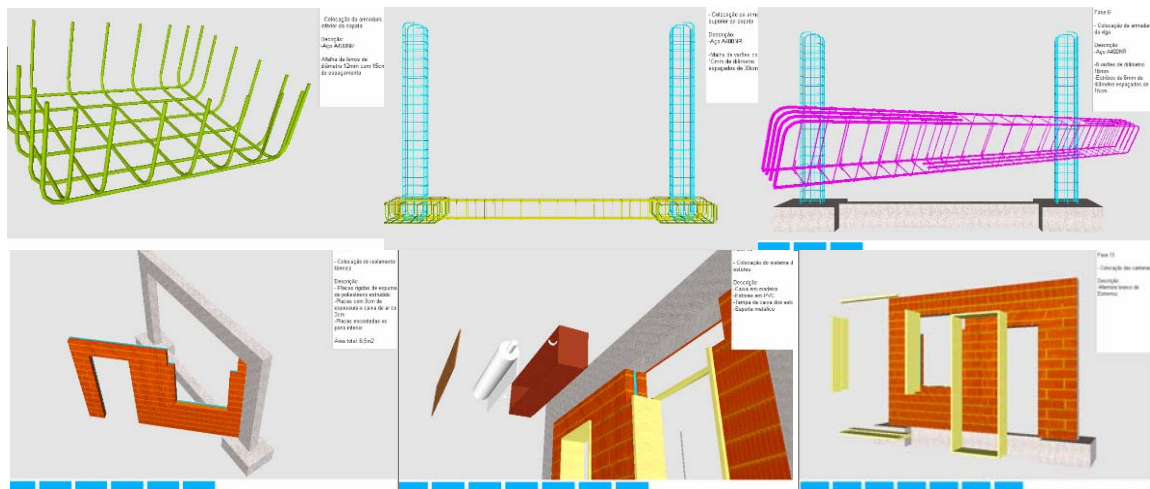


Figure 2. Exhibition of phases of the wall construction

The development of the model was supported by engineer specialist in construction activity. So this is a guarantee that the model shows the construction sequence in a correct way and the configuration of each component was defined with accuracy. In this educational application, it was important to include details such as:

- Bar showing the construction progress;
- Text with information concerning the stage observed;
- The possibility to highlight elements from the model;
- The accuracy of the reinforcements and the way they connect inside the structural elements;
- The details of the configuration of vertical panels and components of the window and the door.

4. MODEL OF THE BRIDGE

The bridge model allows the visual simulation of the construction of a bridge using the cantilever method. Students are able to interact with the model dictating the rhythm of the process, which allows them to observe details of the advanced equipment and of the elements of the bridge (pillars, deck and abutments). The sequence is defined according to the norms of planning in this type of work.

A computer graphic system which enables the geometric modeling of a bridge deck of box girder typology was used to generate, 3D models of deck segments necessary for the visual simulation of the construction of the bridge. To complete the model of the bridge, the pillars and abutments were also modeled in 3D, then followed the modeling of the advanced equipment, which is composed not only of the form traveler, but also the formwork adaptable to the size of each segment, the work platforms for each formwork and the rails along which the carriages run (Figure 3). As, along with the abutments, the deck is concreted with the false work on the ground, the scaffolding for placement at each end of the deck was also modeled

(Figure 3). Terrain suitable for the simulation of the positioning of the bridge on its foundations was defined as a 3D surface.

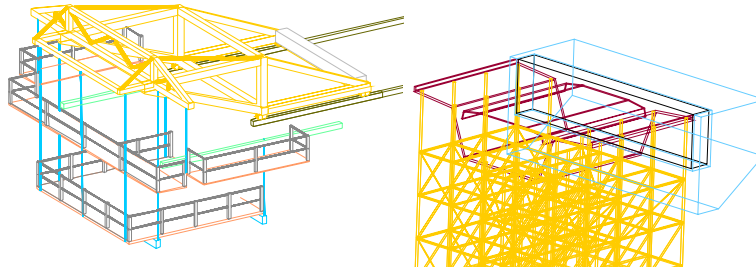


Figure 3. 3D models of the scaffolding and the advanced equipment.

The support of specialist in bridge designs was essential to obtain an accurate model, not only on the geometry definition of components of the bridge and devices, but also on the establishment of the progression sequence and of the way the equipment operates (Figure 4):

- This method starts by applying concrete to a first segment on each pillar, the segment being long enough to install on it the work equipment;
- The construction of the deck proceeds with the symmetrical execution of the segments starting from each pillar, using the advanced equipment;
- The continuation of the deck, uniting the cantilever spans, is completed with the positioning of the closing segment;
- Finally, the zone of the deck near the supports is constructed, using a false work resting on the ground.

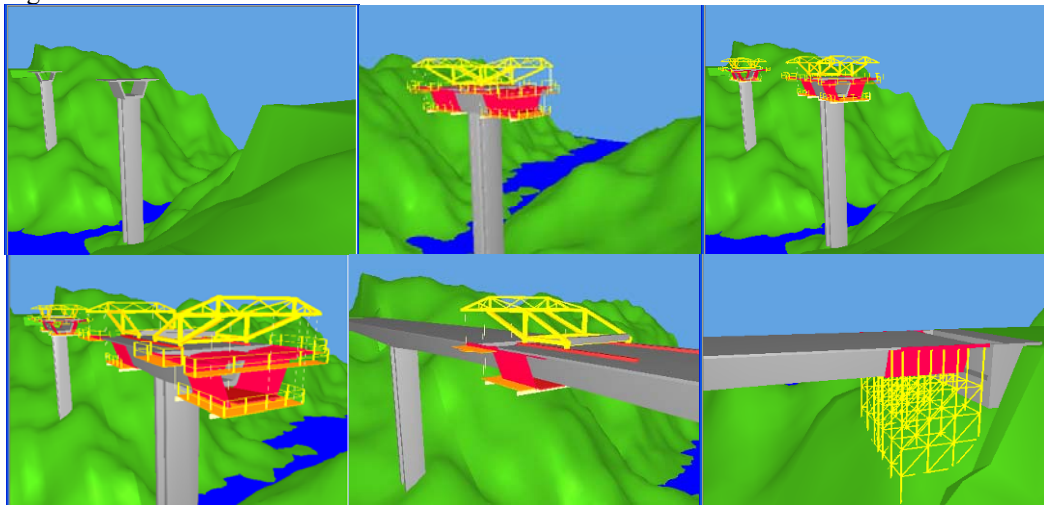


Figure 4. Placing the initial pillars, movement of the advanced equipment and concreting above the false work near the abutment

The virtual model was programmed in order to show correctly this sequence. For the simulation of the first cantilever segment (in each span), the four form travelers, the corresponding work platforms and the formwork components are included in the scenario. Once the first segments have been concreted, the construction of the cantilevered deck takes place. In each phase, two pairs of segments are defined. A closed segment is placed connecting the cantilever decks under construction and, finally, the zones of the deck near the abutments are concreted. For each new segment the following steps are established (Figure 5):

- Rising the form traveler;
- Moving the rails in the same direction as the construction (relocating them on the latest segment to have been concreted);
- Moving the form traveler on the rails, positioning it in the zone of the next segment to be made;

- Concrete the segment.

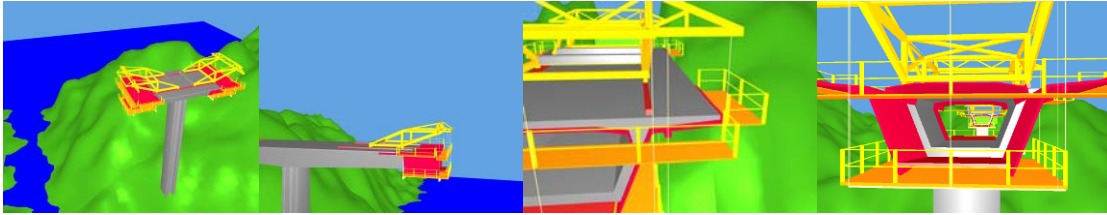


Figure 5. Movement of the advanced equipment

Moving the camera closer to the bridge model and applying to it routes around the zone of interest, the student, interacting with the virtual model, can follow the sequence specifications and observing the details of the configurations of the elements involved. In a real construction place of a bridge, for security reasons, the student stays far from the local where bridge is under construction, so they can not observe in detail the way of operation and the progression of the construction. Interacting with the model in class or using their personal computers they better understand what is going on there in the work place.

5. MODEL OF THE ROOF

Following from those examples, a proposal was put forward to generate an educational model related to the graphic construction of a roof drawing (Sampaio and Cruz, 2008).

Representation using elevation projection is one of the topics in the subject of Technical Drawing included in the syllabus of the module on Computer Assisted Drawing (CAD). This representation uses only the view obtained by horizontal projection, the plan. However, the drawing is complemented by the relevant data, the elevations value and the graphics related to the three-dimensional space.

As far as the roof drawing is concerned the initial data needed are: the specification of the geometric outline of the roof and the slope of each of the roof planes of which it is made up. Based on this information the plan of the corresponding roof is drawn (Figure 6).

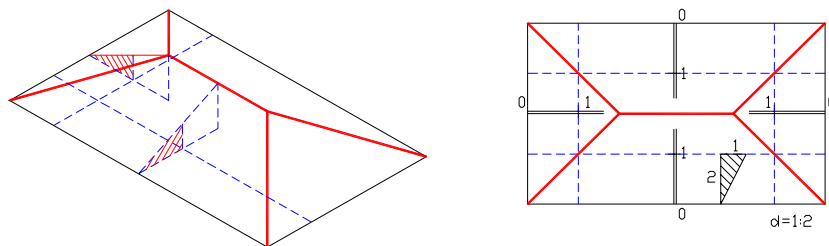


Figure 6. Perspective and drawing of a roof

So, when defining drawings and 3D models some geometric elements must be used: the slopes represented by their corresponding right-angled triangles and the elevation lines. These are shown traced on a plan but they identify three-dimensional elements. In order to facilitate the ability to understand the spatial aspect inherent in the process, a didactic model was created in which all the methodology underlying its construction is presented in a virtual interactive environment. The example selected is composed by two blocks of roof.

- The animation of the model follows the sequence of operations illustrated in Figure 7:
- Presentation of the initial base shape;
- Subdivision of this shape into two polygons;
- Placement of the triangle representing the slope value 2:3 next to one of the edges;
- Insertion of the triangles with 1:1 pitch in normal positions for each of the edges;
- Introduction of the polygon of the appropriate elevation;
- Inclusion of the plane surfaces representing the 4 roof planes;

- Representation of the second of the two blocks which make up the roof;
- Intersection of the two roof blocks.

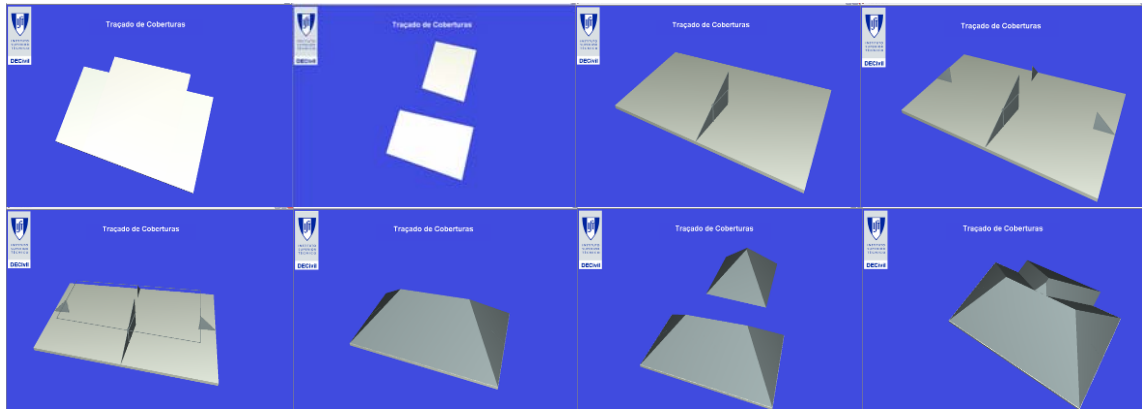


Figure 7. Animation sequence of the roof construction

The model allows interaction with the building process sequence enabling the user to backtrack and manipulate the camera position and distance in relation to the model. The final objective of this model is to show the complete roof constructed on a basis of the concepts of engineering drawing applied to the plan drawing of that structure. The intersection of the two blocks of the roof clearly illustrates how roofs with more than four planes must be executed.

6. LEARNING ASPECTS

The models were placed on the webpage of each discipline staying available for students to manipulate. The student should download the EON Viewer application available at: <http://download.eonreality.com>.

The models are actually used in face-to-face classes of disciplines of Civil Engineering curriculum: Computer Assisted Drawing and Technical Drawing (1st year), Construction Process (4th year) and Bridges (5th year). The traditional way to present the curricular subjects involved in those virtual models are 2D layouts or pictures. Now, the teacher interacts with the 3D models showing the sequence construction and the constitution of the modeled type of work. Essentially, the models are used to introduce new subjects:

- As in *Technical Drawing*, students have to define and draw structural plants over the architectural layouts, the virtual model of the wall helps to explain the connection between the architectural drawings and the structural solutions needed to support the house configuration. Some indication must be assumed when choosing a structural solution in order to minimize the unpleasant visual appearance in the interior of a house when structural elements (beams, columns ...) are included in it. The students are 1st year degree, so they have some difficulty to understand the spatial position of the structural elements and how they must be built and located almost inside the walls. The relationships between the architectural configurations and the structural elements in a building are well explained following the exhibition of the virtual construction of the wall (Figure 8);

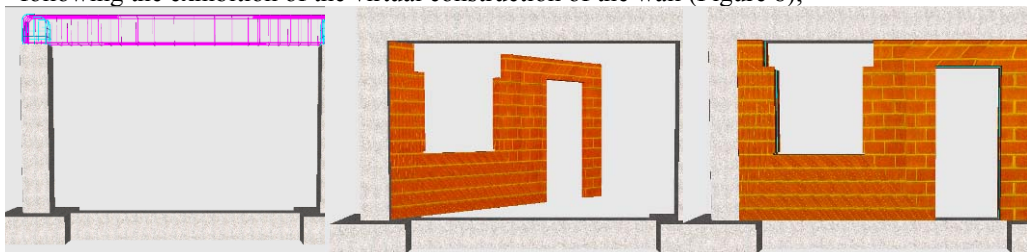


Figure 8. The relationships between the architectural configurations and the structural elements in a wall

- In the discipline of *Construction Process*, in order to prepare students to visit real work places, the teacher shows the construction animation and explains some aspects of the construction process of the wall. Namely, he describes the way the irons are organized inside beams or columns, specially the complexity of the relationship between reinforcements in the join zones of the structural elements. In order to clearly explain this issue related to the structural elements, the iron nets were created as 3D models with distinct colors, and they appear on the virtual scenario following a specific planned schedule (Figure 9).

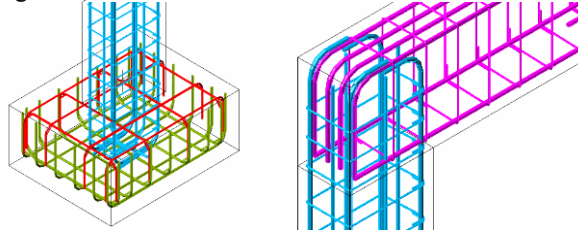


Figure 9. Complex relationship between reinforcements in the join zones of the structural elements

The type, sequence and thickness of each vertical panel that composes a cavity wall are well presented in the virtual model showing step by step the relationship between each other. The configuration detail of each element of a complete wall can be clearly observed manipulating the virtual scenario of the construction;

- The construction model of a bridge particularly shows the complexity associated to the concrete work of the deck bridge that is done in a symmetric way. The model also shows in detail the movement of the advanced equipment. In class, the professor must explain way the process must follow that sequence of steps and the way the equipment devices operates. When the student, of the 5th year, goes to the work place he can observe the complexity and the sequence of construction previously explained;
- The roof model is an educational application to support the discipline *Computer Aided Drawing*. The issues involved require spatial awareness which, in traditional methods of teaching, transmitted through plane view. This application supports the explanation of topics related to the construction of both simple roofs and more complex ones (that is, those that are more difficult for students to grasp). The model shows, in an animated way, the intersection between two simple roofs defining a more complex one (Figure 10).

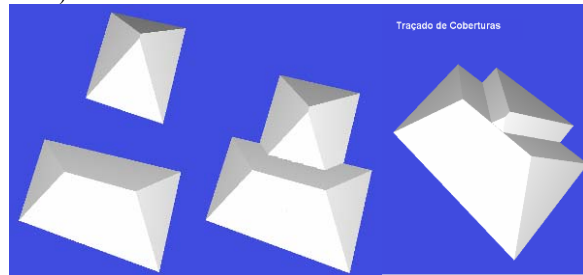


Figure 10. Definition of a more complex roof based in two simple blocks

The gain of using these models in class-rooms, supporting the explanation of particularly complex issues, is significant. Because the new concepts of civil engineering, like beams or deck segments, are unknown to 1st year students, they achieve a better understood of the spatial localization of each element and the relationship between them, by means of interacting with the VR models. In addition, the 4th and 5th year students can better realize how is the work in a real construction place, situation they will observe later along there activity as engineers.

7. CONCLUSIONS

The advantage of introducing new technologies into the creation of didactic material suitable for university and technical education should be made known and applied. There are many other possibilities for the creation of computational models mainly where the subject matter is suitable for description along its sequential stages of development. The applications with these characteristics make the advantage of using techniques of virtual reality more self-evident, especially when compared to the simple manipulation of complete models which cannot be broken down. The pedagogical aspects and the technical concepts must be attended on the elaboration of those both models.

The main objective of the practical application of the model is to support class-based learning. In addition, it can be used in distance training based on *e-learning* platform technology. The involvement of virtual reality techniques in the development of educational applications brings new perspectives to Engineering education.

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STUDENTS' AND EDUCATORS' ATTITUDES TOWARDS E-LEARNING

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ABSTRACT

Several trends bring about different thinking patterns about higher education. Universities are under permanent pressure to change by means of online technology. In this paper the attitudes of more than ten thousand Belgian students and educators towards e-learning and educational renewal are scrutinized. Findings show both groups tend to be conservative, which is reflected in their teaching and learning practice; no significant changes due to internet use were reported. Expectations about the future are centred around the extension of technical possibilities but not educational change. At the current state of affairs and taking into account the views on the future, it seems that e-learning will never replace the traditional settings in Flanders.

KEYWORDS

E-learning, innovation of education, attitudes, students, educators.

1. A CHALLENGE TO INNOVATE

The combination of new ICTs, changing student populations, new education paradigms, and the need for continuing education throughout a lifetime is eroding the foundations of a century-old education system. Among other learning organizations, universities are under permanent pressure to innovate.

Opinions of those who are involved in higher education are divided on this issue. On the one side it is argued education may not be excluded from the opportunities ICTs offer, both because of their didactical and socioeconomic implications. ICT integration in schools and universities is considered necessary so that students can keep up with developments, and are well prepared for living and working in a cyber society (Van Bolhuis & Colom, 1995). During the first World Summit about the Information Society (WSIS) a study group of the ICT Task Force of the United Nations presented an initiative to reduce the delay of the third world on the developed countries by means of ICT in education. The 'Global e-Schools and Communities Initiative' aims at the use of ICT as an instrument for educational improvement and to bridge other gaps (see itu.collects/wsis/). At Unesco's World Conference on Higher Education in 1998, a debate was organized to address the topic of new information and communication technologies (ICTs) and their effects on higher education. Panellists from Japan, Brazil, North America, Africa and Europe participated. ICT's credits for higher education were addressed with a message of hope for the future: expanded availability of higher education; pooling of resources, forging of new partnerships and contributing to 'peaceful coexistence among people' (Unescopress, 1998). In this context, it is expected from higher education that it develops adapted intellectual frameworks and starts with the realisation of all this in practice (Stonier & Conlin, 1985). Penrod and Dolence (1992: 21) added to this: 'Yet others are sceptical or negative regarding their potential exploitation in the educational process. They warn for a dehumanizing effect on and an individualisation of education, plus a situation where students are made too dependent on ICTs (Roszak, 1986). Likewise they express the limitations of ICT use, and emphasize the need for critical reflection. Some of them are plain technophobes.' There is a third approach centered on the application of ICT as a useful tool for research, study, collaboration and learning.

In this view, ICTs can aid education in two important ways: (1) as a motor for launching important innovations in the school, or (2) as a tool for optimising the current situation (Selwyn, 2002).

2. HIGH HOPES AND TROUGHS OF DISILLUSIONMENT

During the past decade e-learning -and the debate on it -has gone through tempestuous moments. This evolution is described in detail in Gartner's Hypo Cycle for Emerging Technologies (Gartner Group, 2006). It explains graphically the common phenomenon of ups and downs in the IT industry of new technologies and products. The adapted version, the E-Learning Hypo Cycle (Figure 1), shows the gap between rhetoric and reality as new ICTs like the internet are introduced into educational settings.

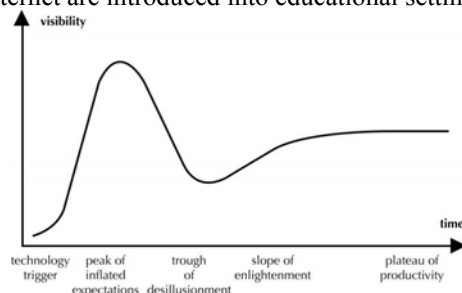


Figure 1. E-Learning Hypo Cycle (adapted from Gartner Group, 2006)

When launched they are overhyped, next they disappoint, before finally maturing and being more widely adopted. Paul Safo (used in Pilot, 1997) discerns three similar typical periods: 1) a decade with an air of great excitement and instability but little market penetration, followed by 2) ten years marked by variability and a starting market penetration and 3) a period where a product evolves to a standard. In general, one can distinguish five phases over time: technology trigger, peak of inflated expectations, trough of disillusionment, slope of enlightenment and plateau of productivity.

Where can we situate Belgium on the map of e-learning? Did we already end up on the plateau of productivity? How do students and professors relate to the application of Internet and educational innovation? Is e-learning as a form of education preferred to no e-learning at all and the traditional university? Which didactic elements are preferred, and what kind of practice? In 2005-2006, we were unable to formulate a well-founded answer to these questions because reliable information was absent. In this paper the author reports about a broad-scale study of internet use by educators and students within a set of Flemish universities, geographically located in the northern and central part of Belgium. 9870 students and 551 educators responded to a web survey, while 40 follow-up structured interviews were conducted with representative subgroups according to age, use pattern, gender and university. In the following paragraphs the reader is presented a summary of the most interesting findings concerning e-learning preferences and attitudes towards e-learning and educational renewal.

3. E-LEARNING PREFERENCES AND ATTITUDES

3.1 Study and Teaching Practice

The results of the study show that both students and educators have high access to the Internet and, on average, spend about 4 hours/week applying it for educational purposes. Flemish institutions are situated in or between the 'through of disillusionment' and the 'slope of enlightenment'. First standards and blended solutions are emerging, but not too many substantive changes in teaching and learning methods.

Overall, the Internet has a weak impact on education; it mainly optimizes and reinforces existing practices and does not fundamentally alter how students and educators approach learning and teaching. E-learning mostly occurs in the larger context of traditional learning environments where curriculum structure, organisation, instruction style, interaction and content remain largely unchanged. Further analysis points out that such e-learning outcomes are related to students and educators' perspectives on contemporary study and teaching practice, their format preference and e-learning attitude.

In the study, topics from the 'e-Pedagogy' section of Stephenson (2001) were adapted to develop a measure for probing into which extent students/teachers prefer certain elements in their (e-)teaching and -

learning (Table 1). This was done through six items, all coded with a Likert scale rating scheme from 0 to 4 (totally disagree - totally agree). In general, there was more disagreement within the student group. Regarding the topic 'dialogue' we noticed a convincing proportion of students and educators that (totally) agreed (resp. 82 and 92%). This element should surely be at the centre of any (e-)teaching-learning process. It is plain most faculty (94%!) preferred teaching practices in which students work independently and search autonomously for solutions, while students had less strong views about this issue. 82% of the students against 61% of the educators reported they need a lot of structure or control.

Table 1. Preferences for (e-)Teaching and Learning. Student and Educator Responses

	Concept	S/E*	(Totally) Disagree	Neither	(Totally) Agree
1.	Dialogue	S	5.7%	12.3%	82%
		E	3.9	5.9	92.3
2.	Control/Structure	S	5.6	12.0	82.4
		E	13.8	25.2	61.0
3.	Active Involvement	S	25.4	35.6	39.0
		E	1.8	7.4	89.8
4.	Tutoring	S	41.3	28.0	30.6
		E	26.8	36.3	36.9
5.	Effort/Time	S	15.1	22.1	62.8
		E	3.2	15.8	81.1
6.	Independence/Autonomy (R)	S	7.6	22.8	69.6
		E	1.1	4.8	94.1

*S=Student, E=Educator

(R) indicates reverse scored item.

Both groups also wanted to put a lot of time and effort into their studying or teaching. With active involvement during class on the other hand, we noticed divided opinions within the student group -with a small majority of students in the column '(totally) agree' (39%) – as distinct from the group of educators which took almost a unanimous stand (90%). The largest spread of percentages was found within the category of tutoring; neither students nor teaching staff agreed on the fact whether students should be coached by professors and assistants during their studies.

The interviews confirmed these findings and added some new elements to our knowledge about the teaching-learning practice. In the first place teaching staff want students to acquire necessary theoretical knowledge and/or learn skills. Also embedding understanding, 'logical thinking in a broader framework' is a goal. Secondly, professors want to rouse students' interest in their field of study, and become motivated to study matter. A third objective is to shape a critical mind about the content matter and more philosophical issues. While the first priority is to prepare students for scientific research, preparing students for the job market is also a goal. The idea is for the graduate to master his profession, have problem-solving skills, possess a critical mind, own a social vision, be flexible, independent and a team player. The roles of an educator are: to be an expert, to guide and to transfer knowledge. The roles are dependent of the educator's personality and his/her course goals. Students expect more or less the same – knowledge, skills and ability to act independently and think critically – in order to be prepared for the labour market. They find the role of a teacher crucial for their learning process. He/she stimulates discussion and reflection, 'creates out of chaos a cosmos', especially if he/she is convincing and if he/she inspires. Internet-based activities are considered of secondary importance. Students expressed a clear preference to get tangible learning material e.g. a companion.

The main idea behind teaching and learning in Flemish higher education is having a professor and a group of students who come together at fixed hours and days during two semesters, each 13 weeks respectively. For many teachers, education equals knowledge transfer and knowledge acquisition. A lecture is the typical way to explain course material, while lab and exercise sessions are set up to gain practical skills e.g. in botany or medicine. Curricula can also include a certain amount of self-study. The size of the groups differ considerably, from 4-5 students to masses of more than 1,000 students. Students follow, make notes, carry out activities. Dependent on the individual educator, there is either interaction with students or not. A quote: 'I like to teach interactively and make things entirely clear via logical reasoning by responding to questions'. Firstly, it seems important to students to get the chief part of the course during class hours. Secondly there is

the information aspect and communication via the Internet. 'If I don't go to the classes I have the feeling that I missed something important.' Is a typical student response. The learning process itself stays an individual activity, not to mention the exception of collaborative learning or working. It is mainly reported as a procedure of hearing (in a classroom), reading (written study material) and summarizing.

Via the open questions, a teacher informs us that they use their experience as a student as a guide for their personal educational style because there is no mandatory training for teaching staff at the university as there is for teachers in secondary education. 'As a young teacher you get thrown in front of the lions'. There is also a possible interaction between the assistant and the professor. Either both adapt their style and insight or one adopts the style and insights from the other.

At one university, education is managed differently than at the other universities. There are blocks of 5 weeks of teaching-learning activities, followed by a week of study and a period of exams. Teaching and learning is carefully planned with lectures, responsive lectures, work sessions, group and individual assignments as well as self-assessment tests. It is expected from students to be active participants, engage in peer reviews, and especially be eager to learn in teams and by means of self-study. The digital learning environment is integrated to work with all these different approaches and in some cases problem-based education is applied.

3.2 Format Preference

In this study, students and educators chose as an ideal educational format a combination of virtual and traditional approaches over the two extreme alternatives. Hardly 1.3% of the student and 0.2% of the educator respondents is positive about a full integration of Internet in the education and learning process. It is clear that current students prefer not to graduate with exclusively traditional education (6% opted for this choice) and 1.8% of the staff wanted to hold on to traditional teaching methods.

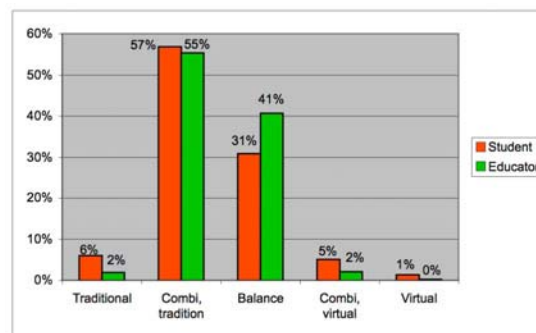


Figure 2. Preferences for (e-)Learning Format

We saw on the basis of the corresponding bar chart (Figure 2) that the largest part of respondents chose a combination of traditional and virtual education, with an emphasis on traditional (56.8% for students and 55.4% for educators). More than a third of all students and forty per cent of the educators pronounced his/her preference for an equal balance between both education systems. The remaining 5 and 2 per cents reflected students' and educators' preference for a blended format with a bit more e-learning.

For many respondents it did not seem necessary to switch as much as possible to Internet-based education; classical modes of education should be preserved. They pleaded strongly for a preservation of classroom education: for the most part face-to-face and a small part electronically. Many claim a university with a campus should stay, as well as seminars, exercises and ex-cathedra education. Teaching staff form the necessary links: sources of knowledge and know how. They bring structure and extract information from knowledge. Virtual education is in their view typically predestined to learners from abroad, or in special education, in-service, lifelong learning or extra training programmes. We noted one extremely peculiar comment: '(...) I would regret a stronger push for e-learning. (...) approximately one or two per cent of the people are 'electro hypersensitive' (...), these people will feel sick in front of a computer. How can these people learn if we push further for e-learning? Will they miss the boat?'

3.3 E-Learning Attitude

We assumed that a general, overall construct of orientation toward e-learning exists. We have defined ‘e-learning attitude’ as the personal disposition towards e-learning or ‘beliefs about, feelings toward, and disposition to respond to various aspects of e-learning’ (cf. Frederico, 2001). It is the net result of evaluating and associating the (innovation) Internet with his or her (innovative) teaching/learning purposes (by analogy with Davis, 1993). The items are listed in Table 2, along with the respective mean scores and standard deviations per respondent group.

Table 2. Means and Standard Deviations for the E-Learning Attitude Scale. Student and Educator Responses

Construct and Statements		Student	Educator
		M (SD)	M (SD)
Innovativeness			
1.	In general I am very cautious as far as accepting new ideas is concerned. (R)	2.48 (.97)	2.51 (1.00)
2.	I enjoy changes in my study habits or study environment / teaching practices	1.83 (1.00)	2.67 (.85)
3.	I am always looking for new study / teaching methods.	1.36 (.96)	2.36 (.95)
4.	I am suspicious about new working methods until I notice among people around me that they are actually efficient. (R)	2.46 (.90)	2.71 (.93)
Perceived Value			
1.	The Internet is easy and pleasant to use.	2.89 (.86)	2.94 (.77)
2.	Internet is a useful instrument for my studies. / I think I can achieve (part of) my educational objectives more efficiently by using the Internet.	3.34 (.72)	2.68 (.99)
3.	Thanks to the Internet I can do (part of) my study / teaching activities at various places and times.	2.44 (1.01)	2.58 (1.13)
4.	I see various application possibilities of the Internet for education and learning.	2.71 (.87)	2.97 (.71)
5.	Thanks to the Internet, education fits in better with the job market.	2.15 (.88)	2.29 (.95)
6.	If I could choose between a physical class version and an Internet version of a class, I would choose the Internet version. / By using the Internet I can innovate my teaching.	1.10 (1.12)	2.77 (.84)
7.	I can easily fit the Internet into my daily study / teaching activities.	2.87 (.86)	2.60 (1.00)
8.	The Internet allows me to perform certain study / teaching tasks faster.	2.88 (.96)	2.57 (1.10)
9.	My academic capacities increase if I use the Internet during my studies.	2.25 (.88)	2.58 (.94)
10.	The Internet can eliminate certain irritating or boring study / teaching tasks.	2.32 (.96)	1.97 (1.04)
11.	Taking an education / Teaching with the help of the Internet is too time-consuming. (R)	2.49 (1.03)	2.25 (1.07)
12.	I find it necessary to use the Internet for my studies / teaching.	2.95 (1.01)	2.30 (1.19)
13.	I expect all university lecturers / students to use the Internet for teaching / studying purposes.	2.35 (1.11)	3.02 (.89)
14.	Learning how to use the Internet is worth the effort.	3.44 (.75)	3.54 (.65)
15.	Using the Internet for teaching and learning fits in today's society.	3.15 (.69)	3.33 (.67)

(R) indicates reverse scored item.

The construct was operationalised as a scale consisting of 19 statements. We determined a priori two dimensions to define it: general innovativeness and perceived value of the Internet for educational purposes.

Responses were scored on a five-point Likert-type scale ranging from 0=strongly disagree to 4=strongly agree. Means of all 19 items varied from 1.10 to 3.4. Further, the standard deviation for all variables had in most cases a value less than 1, indicating there was not too much variation among opinions to each statement.

It seems both groups were, on average, quite positive on the use of the Internet for educational purposes. Looking at the lowest and highest values, the respondents agreed learning how to use the Internet is worth the effort and using the Internet for education fits in today's society. The student group agreed to a large extent that the Internet is a useful instrument for their university studies, while, on the other hand, teaching staff expect from all learners to use this medium. Educators are less positive about the possibility of the Internet to eliminate irritating or boring teaching tasks. What is striking are the differences related to innovativeness: while educators showed interest for innovation in teaching, students did not like so much new methods or changes in the environment. They also clearly indicated that when given a choice, they would not choose the Internet version of a class ($M=1.10$). Though we noticed a certain resistance against non-traditional modes of education (in agreement with the survey data), interviewees appeared fairly positive about the practical value of the Internet for educational purposes. An example: 'I am in favour of the introduction of Internet in education. One gets many chances to discover things that one would never be able to find otherwise or for which one would need to go to the library. It is possible to get into touch with many people all over the world.' On the other hand, many declare 'I think I would be able to live without Internet. It certainly is useful, but I am not convinced it is necessary.'

4. IMAGES OF THE FUTURE

In the general comments and via the interviews we collected a lot of useful information about what students and teaching staff really thought about the future of e-learning. In the long term, only a few of the interviewees or participants to the survey expressed a wish for 100% virtual university education or distance e-education. Towards a university without a campus? 'I hope not' is the most frequent answer to this question. With the exception of a few, almost all interviewees express their fear for extreme virtualisation of higher education. One hopes that the campus as a point of contact and the university and its professors and assistants as educators will continue to exist. Although they expect that the application of Internet will grow - especially for self-study, rehearsal and note-taking - they do not expect too much change from the Internet in future education. Log in on digital classes is not wished for at all, while the integration of more audio and video applications within the digital learning platform is welcome according to students. They would like to:

- i. have all course outlines, notes, and materials that were used in class online, available to download (preferably in print-ready format, e.g. Pdf);
- ii. send assignments, work-in-progress (e.g. master's thesis) by e-mail;
- iii. be able to follow courses via a pc (in real-time or not);
- iv. professors and assistants to hold online office hours;
- v. receive results from assessments or exams in a secure way via e-mail or the learning platform;
- vi. study at a distance in the framework of an international exchange programme;
- vii. participate in separate (online) self-study courses which would be honoured with a certificate;
- viii. have less contact hours, more independent study.

Part of the teaching staff were in favour of:

- i. a differentiation of learning paths;
- ii. shared workspaces and individual calendars;
- iii. product-and process-based portfolios;
- iv. integrated use in different courses.

For some these lists are more than a maximum scenario, especially the italicized items. For others, e.g. working students and educators that are often abroad, these are ideal scenarios. While the interviewees anticipate universities will attract new target groups of students due to e-learning they do not expect internationalization. The biggest problem is the language of education. On top of that, when someone wants to study or work abroad he/she still prefers to travel. A decrease of educational quality is expected, although this is not per se related to extending e-learning.

5. CONCLUSION

The outcomes have clearly shown how difficult it is to plan and predict innovative technology use. A future as predicted by Lefrere (2001) with virtual universities that are widespread and widely accepted within the whole of Flanders seems rather unlikely. While many claimed to observe massive changes, in reality there is a limited impact of Internet integration. With regard to the core values of pedagogy higher education has not yet really evolved much in relation to a hundred years ago. To a large extent university education involves ex cathedra teaching. Moreover, this kind of teaching-learning processes have been bound to specific places and proposed times and sequences. Expectations about the future are centred around the extension of technical possibilities but not educational change. At the current state of affairs and taking into account the views on the future, it seems that e-learning will never replace the traditional settings in Flanders.

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AUTHORING ADAPTIVE COURSEWARE WITH ENHANCED METADATA SUPPORT

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ABSTRACT

In recent years, the number of adaptive applications for e-learning content delivery increased immensely. Usually, such applications have own authoring tool or use external one in order to create learning materials. However, very few authors of educational content use such systems. The reason is that the tools are rather complicated and follow modern e-learning standards, which leads to a need for content authors to fill multiple metadata for their learning materials, which requires much time. In this paper we present an authoring tool, which is a part of a platform for building edutainment (education plus entertainment) services – ADOPTA (ADaptive technOlogy-enhanced Platform for eduTAinment). This authoring tool provides inheritance mechanisms for learning object metadata descriptions, metadata for semantic ontology graphs, and good integration with instructor tool for creation of adaptive courseware.

KEYWORDS

Metadata, ontologies, LOM, AHS, learning style.

1. INTRODUCTION

In last fifteen years, authoring and delivery of adaptable e-learning courseware appears to be very important for design of modern learning management platforms. During that period, there have been proposed a lot of works identifying the key challenges in adaptive Web based multimedia information delivery. The chief goal of personalised and adaptive e-learning was formulated in (Dagger, 2005) as assuring of “e-learning content, activities and collaboration, adapted to the specific needs and influenced by specific preferences and context of the student”. In order to achieve that goal, Adaptive Hypermedia Systems (AHS) possess abilities for provisioning of various forms of adaptation, such as adaptive navigation, structural adaptation, adaptive presentation and historical adaptation (De Bra, 1999). Some research groups focus on adaptability to learners’ current knowledge based on the theory of knowledge spaces. The use of learning objects provides an excellent opportunity for learners to apply their own meanings in various information contexts. Dynamic adaptation is used in different instructional scenarios with content package adaptation facilitated by wide usage of Web services (Leune, 2004). Other researchers introduce additional level of system self adaptability based on the idea that different forms of learner model can be used to adapt content and links of hypermedia pages to given user (Díaz, 2002). The adaptability is based on clean separation of the learner model from the content model and from the adaptation model, without narrative or pedagogical model to be embedded in the authored content or the adaptation engine. It supposes dynamic changes in adaptation process based on modification of the content parameters according input from learner passing hypermedia resources and assessment about their understanding (Brusilovsky, 1994).

Until the present moment, there have been investigated several main techniques for adaptation, such as adaptive navigation/presentation/content selection/problem resolution (Vassileva, 2004). It is obvious, that applying one or some of the techniques above will strongly depend on organisation and structuring both the models of learner and the domain model. Learner modelling influences instructional design research and solutions by single learner’s characteristic determining effective individualization of learning (Conlan, 2002). Since recently, however, the adaptive software application paradigm has been shifted to learning style construct (Stoyanov, 2005). The learner model is used for managing adaptation as defined by specific rules

for adaptable content delivery and assessment based on usage of both the learner and the domain models, and executed by the adaptation engine for adaption to individual learners (Vassileva, 2006).

The paper describes authoring of e-learning courseware adopted in the scope of ADOPTA (ADaptive technOlogy-enhanced Platform for eduTAInment) for building edutainment (education plus entertainment) services for both Universities and industry. ADOPTA has been under development at Sofia University, Bulgaria, since 2007 and already provides authoring and instructor tools for e-learning courseware design, with intention to be extended for edutainment support. The adaptation engine is still under development - it executes rules controlling the adaptation process toward the learner model. The authoring process is strongly separated from the instructor's learning design and is based on semantic ontology graphs - exported in Ontology Web Language (OWL) (Moreira D., M. Musen, 2007) and inheritance mechanisms for metadata descriptions of both the learning objects and ontologies. For describing metadata for learning objects (LOs) we use Learning Object Metadata (LOM) (Krull, G., 2004), while for semantic ontologies we rely on the new coming Ontology Metadata Vocabulary (OMV) (Hartmann, J. et al, 2005).

2. A TRIANGULAR CONCEPTUAL MODEL OF AHS

Our AHS model described in details in (Vassileva, 2006) follows a metadata-driven approach, explicitly separating narrative storyboard from the content and adaptation engine (AE). Fig. 1 represents the triangular structure of our model which refines the AHAM reference model (De Bra, 1999) by dividing in three each one of the learner's, domain, and adaptation models. This is a new hierarchical organizational model for building adaptive hypermedia learning management system. At first level, the model is based on a precise separation between learner, content and adaptation model, while at second level each of these sub-model is divided into three others sub-models. Some of the sub-models may be defined by XML schemas, such as learner characteristics, content – by means of Sharable Content Object Reference Model (SCORM), ontology (OWL), metadata (LOM and OMV), and rules – in Semantic Web Rule Language (SWRL) (Mei, J. and Boley, H., 2006), for a better cross-session interoperability and consistency.

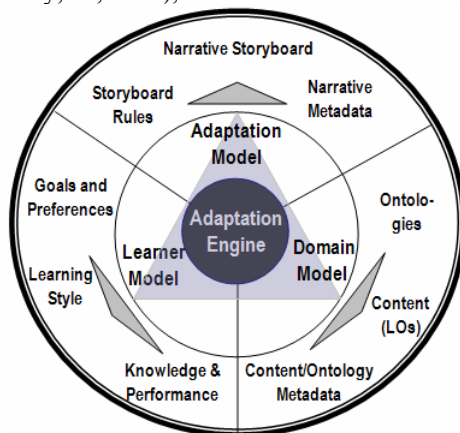


Figure 1. Structure of the triangular model

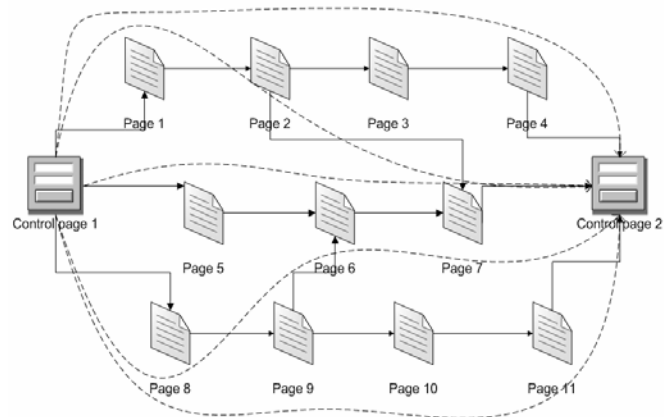


Figure 2. A sample narrative storyboard graph

The main benefit of the proposed model is in assuring strong independence of any of the building models and, at the same time, in facilitating a flexible adaptation of content delivery. It can be supported by different system architectures not limiting application of various adaptation techniques, such as adaptive content presentation, navigation supporting and content selection. In order to be able to describe polymorphic learner profiles, we define conceptual characters of given domain such as learning styles, psychology characters, behaviors (e.g., good or bad), etc. Each of the conceptual characters describing the learner has a weight factor W_{ci} (zero or any integer number,) specifying the importance or the level of presence of that concept (character) inside the learner model. For example, a learner character may be defined by four dimensions being learning styles (activist, pragmatist, theorist and reflector) and having specific weight. Thus, a learning style having no importance or not being present receives zero weight. Learning styles are assessed through pre-test; if the sum of their weights is always a constant number then their weights may be represented in

percentages with a total sum equals to 100%, however, this is not mandatory. Note, that the learner model is not oriented towards one of the existing learning styles models - such as that of Honey and Mumford, Gregoric-Mind, Dunn and Dunn, etc. (Karagiannidis, C. and Sampson, D., 2002) - and can be used for any of these style models.

Unlike other approaches, in the learner model we separate goals and preferences from shown knowledge and performance, as the first sub-model (goals and preferences) is static while the second one (knowledge and performance) is rather dynamic and is used for adaptive content selection. The third sub-model is about learning styles and takes a part in the event-driven storyboard monitoring assuring adaptive navigation. Depending on the style model, learner characters could be activist, theorist, pragmatist or reflector, or such as visual, auditory, or kinesthetic, or others. The learning style is detached as separate sub-model and can be used for choosing best content for a learner possessing given mixture of learning styles as far as most of learners cannot be determined only by one style. While the learning style can be determined in the very beginning of the learning explicitly by the learner or by appropriate pre-tests, other tests should be exercised during the e-learning process in order to assess prior or gained knowledge and performance results of each individual learner.

The domain model is composed of content itself (granulized in LOs according to the SCORM standard), semantic ontologies organizing the content of LOs, and metadata of LOs and ontology. There are supported various types of LOs – not only narrative content but also any learning activity such as task, topic for writing an essay, assessment question, game, etc. The semantic ontology should be specified by the course author at the beginning, in order to form a logical taxonomy for the knowledge domain (i.e., domain ontology) during the authoring process. Thus, the content LOs are developed by the author and next are placed by the course instructor on course pages.

The adaptation model (AM) describes the selection logic and delivery of learning activities/concepts. AM includes a narrative storyboard sub-model supporting course storyboard graphs. It consists of control points (CP) and work paths (WP) meaning the path from one control point to another. In fig. 2, WPs are five and are shown in dotted lines. Within one storyboard graph, the instructor may create various WPs for different learning styles. LOs are situated on storyboard pages representing nodes within course storyboard graph. Moreover, AM should provide a schema of storyboard rules used for controlling the e-learning process. Storyboard rules determine sequencing of the course pages upon inputs from learner sub-models. The narrative metadata sub-model sets such rules for given learning style, for passing a CP (e.g., as threshold level of assessment performance at that CP) or for returning back to the previous CP.

Content pages delivery is controlled by the adaptation engine for choosing most appropriate both WP (by adaptive navigation) and content (by adaptive content selection, link annotation and hiding, etc.) for presenting it to a learner with given learning model. Instead of choosing dynamically a page (i.e. node of the storyboard graph) with its content, we propose choice of best working path within the graph for specific learner with given learning style on one hand, and shown prior knowledge and performance on the other. For this purpose, we define storyboard CPs as nodes of the storyboard graph, where AE either measures learner knowledge/performance, or receives input about satisfaction level of learner's goals and preferences. When a learner starts a new course, adaptive engine finds the best path for him/her in the course graph. The best path is that one with the highest weighed score and is calculated for a particular user as a sum of products between weights (for each existing learning style) of working paths starting at the CP, and weights of their correspondent learner's styles, i.e. the maximal vector product between the vector of the learner and the vectors of the work paths starting from a CP. The best path is stored for learner as current work path and is shown to the learner by a link with appealing link annotation, while other paths are shown with worse annotations or are hidden. When learner asks for the next page, adaptive engine may hide objects that are not appropriate for this user. At any page with some links leading away of the selected work path, the learner is free to press such a link and to abandon the path. In such a case, the learner may choose to navigate to pages through the new path or to return back to the selected path. If he/she navigates through the new path until reaching a new CP, then the AE stores the pages of the new path and selects questions related to the shown LOs placed by the instructor at these pages. After learner assessment, AE recalculates the work path weights for each of the existing learning styles, using the learner performance result at this CP. Thus, the AE tunes (or calibrates) the paths' weights conforming shown learner performance for the path passed by the learner.

3. AUTHORIZING ADAPTIVE COURSEWARE WITH ENHANCED METADATA

This chapter provides description of authoring of creating learning objects organized in ontologies and used within the instructor tool to create and maintain specific e-learning courseware. Before starting explanations about the authoring process, we present a brief overview of the system architecture.

3.1 Principal Architecture of an Adaptive Hypermedia System Based on the Triangular Model

The software architecture of the adaptive hypermedia system being under development is component based. Fig. 3 shows a general view of the system by representing a UML deployment diagram. There are four application clients – one of each of the actors (author, instructor, learner and administrator). The server side components of the author and instructor clients are respectively an authoring tool and storyboard graph and page composers. All of them use a common business API. Learning content is structured by means of usage of XML schema/DTD for LOs and metadata and is stored within a content database, while storyboards and learner models are saved in separate databases. The adaptation engine takes central part in the system and communicates to the business API and to the administrator and the learner applications. AE executes rules defined either in Drools (Proctor, M. et al, 2008) and SWRL (Mei, J. and Boley, H., 2006) and, thus, assures adaptation of content delivery by means of using the pages and rules mastered with both the authoring and instructor tools.

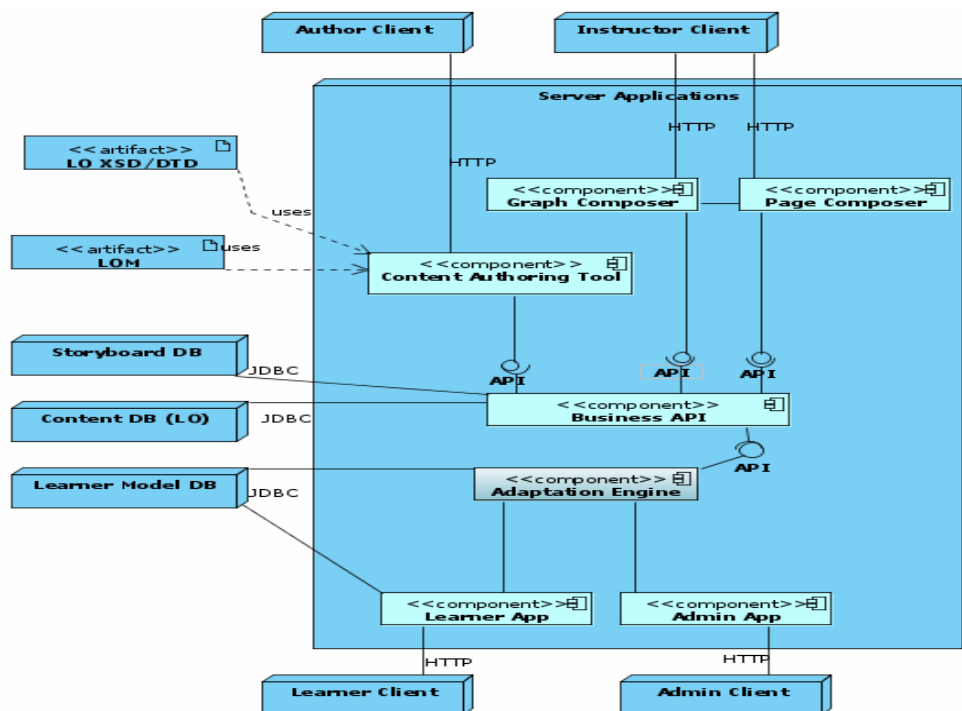


Figure 3. General view of the system architecture

3.2 Content Authoring with Metadata Support

Authoring process supposes definition of LOs and their semantic organization for a facile viewing and searching. Each ontology may be presented not only by a tree -as in Protégé (Moreira D., M. Musen, 2007) - but also by graph, which adds more semantic power and facilitates presentation of multiple inheritance and references from one LO to another. There are two possible types of relations supported between the nodes

(i.e., between the learning objects involved within the definition): inheritance relations (called also *is-a*) and references with semantic *concerns* (called *has-a*). Ontology graphs allow node self-references and, also, mutual references between two or more nodes.

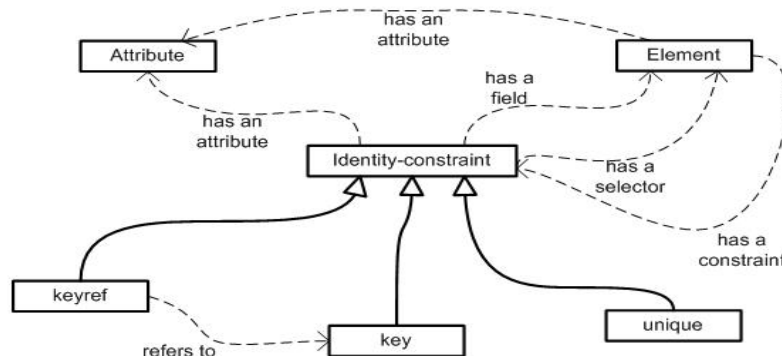


Figure 4. Sample ontology of XML Schema Integrity-constraint

The figure above represents an ontology defining XML Schema Identity-constraint. Relation of type *is-a* are shown by traditional inheritance link while references are given in directed dotted lines. The ontology states the Identity-constraint issue allows definition of one of three sub-classes: unique, key and keyref. A key-ref has to refer to a key, while integrity-constraint itself has to contain an attribute, a selector and a field.

The concept of integrity-constraint is explained by a sample multimedia learning object as shown in fig. 5. The object contains formatted text, a picture and a link to audio lesson. Within the textual explanation, there are

Title: Identity-constraint	
<p>The Identity-constraint issue allows definition of one of the following three sub-classes:</p> <ul style="list-style-type: none"> ❖ unique: this identity-constraint asserts that within a certain scope (specified by the “selector”) the values of a certain “field” or a certain combination of “fields” have to be unique. In this context, a “field” can be either an attribute or a simple type element ❖ key: the value of the identified “field” has to be unique and cannot be nil (i.e. it has to be present) ❖ keyref: this identity-constraint asserts a correspondence of the values of a certain “field” or a combination of “fields” and the value(s) of the referenced key. ❖ Identity-constraints have a name <u>attribute</u> and element content with selector <u>element</u> or field <u>element</u> (for viewing descriptions of element and attribute, click on the corresponding links). <p>To follow an audio lesson about integrity constraints press here. The left figure gives an example of XML representations for the three kinds of identity-constraint definitions (source: http://www.w3.org/TR/xmlschema-1).</p>	<p>Example</p> <pre><xs:key name="fullName"> <xs:selector xpath="//person"/> <xs:field xpath="forename"/> <xs:field xpath="surname"/> </xs:key> <xs:keyref name="personRef" refer="fullName"> <xs:selector xpath="//personPointer"/> <xs:field xpath="@first"/> <xs:field xpath="@last"/> </xs:keyref> <xs:unique name="nearlyID"> <xs:selector xpath="//*/> <xs:field xpath="@id"/> </xs:unique></pre>

Figure 5. Sample learning object defining the issue of XML Schema Integrity-constraint

The author may design the ontology using a top-down, a bottom-up or a mixed approach. While node relations of type *is-a* are defined directly within the ontology graph, reference relations (usually known as *has-a* relations) are defined while designing the learning object. This constraint is especially dedicated to force the author to allocate a hyperlink to the referenced object within the content of the referring object, probably, with a proper textual explanation as shown in fig. 5. Defining internal hyperlinks within one LO to another LO builds automatically reference links as represented in dotted line in fig. 4 (the Integrity-constraint LO refers to Element and Attribute). If the instructor places such an LO at a course page, mouse clicks at a hyperlink to another LO will open a new page window showing this object, while links to external URL like the text about the source at the end of fig. 5 will open new browser window with that URL.

LOs may be of various types such as conceptual issue, project task, essay, etc. For anyone of these LOs, the author may design one or several assessment LOs. An assessment object is a QTI question (Radenkovic, S. et al, 2007) with several answers, for the moment, of type one-of-many or many-of-many. For each answer, the instructor defines a result value. Questions may be only referred by other LOs of type not being question, and cannot refer to other LOs. Moreover, question LOs are not shown at course pages but are used by the adaptation engine to build an assessment tests at next CP.

Our authoring tool is based on reusing the already existing authoring tool of ARCADE (Architecture for Reusable Courseware Authoring and Delivery) e-learning platform (Bontchev B., D. Vassileva, 2003). As far as it may run as a standalone application, we have integrated its extended version into our system. In this version (fig. 6), the learning content is presented by LOs connected each other within a semantic ontology graph. LOs may be primitive (containing plain text, table, image, audio, animation, video, external resources, or links) or composite (aggregating other LOs). Simple LOs may have linear structure – fig. 6 presents such an object containing two text paragraphs and an image. Though fig. 6 shows a LO with linear structure, LOs may be composite, with a hierarchical, tree structure. As well, LOs may have various *resource types* – narrative content, task, assessment question, etc.

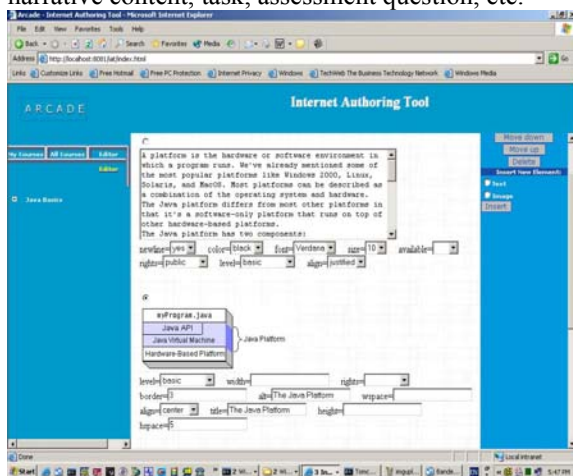


Figure 6. Creation of a LO with the authoring tool

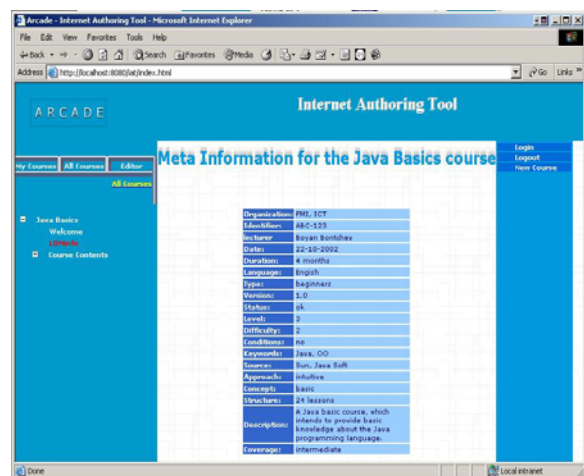


Figure 7. A sample view of LOM

For creation of the ontology itself, OWL (Ontology Web Language) is used as far as it “permits definition of sophisticated ontologies, a fundamental requirement in the integration of heterogeneous information content” (Shadbolt, N. et al, 2004). We make use of OWL Lite to specify classes and subclasses, properties, data types, etc. The LO content is constructed in a Web-based editor accordingly the SCORM standards and specifications for packaging of web-based e-learning content developed by Advanced Distributed Learning Initiative. Each of LOs is described with its metadata accordingly IEEE LOM (fig. 7). LOM provides opportunities for more effective search for LOs, reuse of learning content and possibilities interoperability with other authoring tools, environments or repositories.

Another benefit of using the tool is lack of need to specify LOM for each LO, which is more than boring as LOM contains more than 80 records. The tool provides inheritance mechanism of LOM through the ontology, where LOs lying down inherit LOM from upper objects and may redefine it. Thus, the author should define a full LOM description only for the top LO class within the ontology, while for the other LO (subclasses) this description will be inherited with possibility for overriding (redefining) any field. The tool implements several rules controlling the inheritance process:

1. Any newly defined subclass (by using *is-a* relation) automatically receives the LOM description of its ancestor;
2. Any inherited field of the LOM description may be changed, which marks this field as overridden;
3. If a field of the ancestor LO is changed, then this update will spread down the ontology graph through subclasses/properties/data types until the ontology leaves but will surpass (i.e., will leave unchanged) any overridden field
4. If a LO uses multiple inheritance (i.e., has several *is-a* relations), then in case of concurrent changes in LOM records of the ancestors the author should merge the changed records manually;

5. Relation of type *has-a* are not used when determining LOM inheritance.

On other site, the authoring tool provides abilities for annotating the ontology itself – by means of Ontology Metadata Vocabulary proposal given in (Hartmann, J. et al, 2005). This is a key issue for future sharing knowledge on the Semantic Web by reusing existing ontologies. We modeled further classes and properties representing environmental information and relations such as: Party, Organisation, Person, OntologyType, LicenseModel, OntologyLanguage, etc.

3.3 Using Authored Content for Adaptive Courseware Design

The instructor tool is a Web application for creating courses adaptable to different users. Instructor composes a course in terms of interconnected pages represented as nodes of the narrative storyboard and connected each other. The narrative storyboard graph is to be processed by the adaptation engine in order to choose the best path for a particular user. The instructor may browse LO ontology as defined by the author, read LOs and, finally, compose pages with learning content. Moreover, he/she could copy or drag-and-drop branch of the ontology graph or only a single LO. A course exam in a CP is generated automatically based on the learning objects used in pages on the work path leading to that CP, and questions related to these LO (as far as they are designed by the course author and linked to correspondent LO within the ontology graph). Thus, it is not up to the instructor to determine every single question. To tune the course feedback he/she can adjust CP thresholds values, i.e. assessment results for passed exam.

Instructor has also the responsibility to annotate page links and to set page weight parameters for each of the characteristics of the learner model (i.e., parameters showing how much given page with LOs is suitable for given learner character). These page parameters are very important for tuning the system. Adaptation engine use them to decide whether given page would be useful for particular user or not. If a page has high value of the parameter for given learner character and this character is dominant for a particular learner, then this page should be principally shown to that particular learner. Thus, if a work path (from the current control point to the next one) contains many pages suitable for particular user while other paths do not, then this work path will be nominated for the best path for such a user. Links annotation labels can be added also by instructor to influent user's decision when a particular user is choosing among several links.

Instructors have the ability to filter LO of given type (task, assessment, essay, etc.) in order to choose a proper LO of such a type and to place it onto a page within the narrative storyboard. The filtering process uses LOM description, namely the resource type field. In such a way, instructors are able to place at course pages learning objects proper to a given learning style.

4. CONCLUSION

Adaptive hypermedia platforms continue being a challenging issue for modern e-learning. The paper aimed at presenting the authoring process of adaptable content within the context of using the ADOPTA platform. A key issue was separation of the authoring and instructor environments unlike other similar approaches, as far as authors design learning content and instructors master learning design using that contents. In this way, given content may be reused in many courses, by different instructors.

As a whole, the authoring tool does not constrain granularity of created LOs. As far as authors create fine-grained LOs (such as separate text paragraphs, tables, images, etc.), they may reuse and repurpose them (by internal links or by embedding) or may redesign their contents (by storing an original LO under new name).

Both the authoring and instruction tools described over are specially designed to support adaptability. The adaptation is based on creating different work paths within given narrative storyboard and adaptive navigation through it and, as well, on adaptive content selection and link annotation through the selected path. Learners are not obliged to follow that path but in any case their assessment will make the adaptation engine to recalculate path's weight.

Among the key benefits we offer to authors and instructors, are the automatic build of assessment in control points, repurposing of LOs, inheritance of LOM, and metadata for ontologies. Learning object metadata records are going to be used to develop effective search and location of learning objects, and also to develop automated or semi-automated selection and composition tools.

ACKNOWLEDGEMENTS

The work reported in this paper is supported by the ADOPTA project funded by the Bulgarian Ministry of Education under no. D002/155, and partially by the SISTER project funded by the European Commission in FP7-SP4 Capacities via agreement no.: 205030.

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THE IMPLEMENTATION OF INFORMATION SYSTEMS AS A MAJOR STAKE IN THE DEVELOPMENT OF INNOVATIVE ORGANIZATIONS OF INTERFACE TO IMPROVE THE FRENCH HEALTHCARE SYSTEM

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ABSTRACT

Nowadays all developed countries deal with important problems with their Healthcare System. They face overwhelming challenges with increasing costs and deficits. They try to search efficient solutions in an improvement of the Healthcare System management through new uses of information and communication interactions. France faces a stronger challenge due to its highly compartmentalized Healthcare System, particularly between primary care level and hospitals.

The key goal is to transcend compartmentalization (curtains) thanks to new uses of information and communication interactions. We must share very sensitive Health data to build cooperative management. The main challenges are interoperability and a global approach to complex systems. They converge on the development of interface organizations. Being innovative, integrated and “holographic”, they constitute an original response, especially the Healthcare Networks (*réseaux de santé*). These coordination organizations depend mainly on their reliability and the usability of their Information Systems. The stakes converge on the development of Regional Information and Communication Systems and evaluation’s challenges.

KEYWORDS

information systems, interactions, healthcare, networks, evaluation, complexity.

1. INTRODUCTION

Nowadays all developed countries deal with important problems with their Healthcare System. They face overwhelming challenges with increasing costs and deficits. They try to search efficient solutions in an improvement of the Healthcare System management through new uses of information and communication interactions. These approaches are accelerated by the meeting of health’s challenges and information technology tools. France faces a stronger challenge due to its individualistic way of thinking and its highly compartmentalized Healthcare System, particularly between primary care level and hospitals.

The keyword is “performance” or “managing to do better” (Moore, 2000) using new management approaches: total quality management, management by project, management by processes. All these approaches rest on new uses of information and on communication’s interactions: implementation and improvement of Information System (IS) have become imperative.

This paper is based on years of cooperations around a Master’s degree. Our approach is interdisciplinary centred on information and communication concerns. We mainly use qualitative methods. They include interviews with the main actors (doctors, hospital staff, ministerial and healthcare officers), the observation of activities, as well as the analysis of documents. In this way, we attempt to outline the different perceptions of actors that need to be reconciled. We mix theory and practical experience, using both ground analysis and conceptual tools to build case studies.

We will begin this paper by pointing out the key goal: to transcend compartmentalization by new uses of information and development of communication’s interactions. Then we’ll outline the obligation of sharing very sensitive Health data. We’ll analyze the main challenges: interoperability and a global approach to complex systems. Interface’s organizations as innovative, integrated and “holographic” ones constitute an

original response, especially the Healthcare Networks (*réseaux de santé*). Finally we show how stakes converge on the development of Regional Information and Communication Systems and evaluation challenges.

2. TRYING TO TRANSCEND CURTAINS (COMPARTMENTALIZATION) WITH NEW USES OF INFORMATION AND COMMUNICATION INTERACTIONS

2.1 A General Awareness

According to V. Fuchs (1998), the main challenge faced by American medicine is “to devise a system of medical care that provides ready access at a reasonable cost”. In the hospital, Glouberman and Mintzberg (2001) distinguish four separately-working worlds, symbolized by four Cs: Cure, Care, Control and Community. Cure relies on physicians, Care depends on nurses, Control and administration are entrusted to managers and Community concerns boards and trustees. For them, the main challenge is going beyond specialized curtains, vertical barriers to reach horizontal coordination. In the USA, Shortell et al. (1996) highlighted an excessive fragmentation, claiming that an integration of these various components is imperative. The goal is to improve the quality of care and to limit costs. Better information management is essential to strengthen coordination processes among all actors involved in the care delivery process.

As soon as 1998, the British Department of Health outlined the challenge in an outstanding report “Information for Health”. This Programme inspired directly or indirectly two laws in France. The law of March 2002 concerned the Rights of sick people and healthcare quality (*Droits des malades et qualité du système de santé*), then the law of August 2004 about Health Insurance (*Assurance Maladie*) reform. Both laws highlighted a growing need to use information more efficiently in order to improve the management of the French Healthcare System (Villac, 2004). In the United States, according to the US Government Reform Committee (2005), bringing the IT revolution to Healthcare is the “Last Frontier”.

In other words, all these approaches meet the idea of K. B. Levitan (1982): information is not only a “source” but an important “resource”: its better use is a level of improvement for the whole Healthcare System. The background is that of “process of informationnalization” pointed out by B. Miège (2004): great development of the uses of information (not only computers) in all the society (in organizations but also in the field of private life).

2.2 A Stronger Challenge in France: An overly Compartmentalized Healthcare System

In France the challenge is more important. It corresponds to fundamental choices in creating the Healthcare System. The main barrier is between private primary care and hospital. Each patient can choose its General Practitioner. Another compartmentalization exists between the Health Ministry (*Ministère de la Santé*) and Health Insurance, between specialist doctors and General Practitioners. Within the hospital structures (cf Glouberman-Mintzberg), compartmentalization develops between doctors and other professionals (e.g. nurses), and among treatment, care and social goals. The patient is said to be “torn” between rival services in public or private hospitals, between different health providers and between professions that are often in conflict. Each profession rivals to defend its own specificity, power and territory. We meet another opposition described by Fuchs or Moore: the tension between the concerns of liberty and equality. The French Healthcare System struggles to choose between individual and collective interests.

According to the Fieschi's report (2003) the individualistic French mind-set makes it difficult to build a culture of information and evaluation or assessment. The key challenge is first how to facilitate information exchange then information sharing and in the long run how to produce information collectively to improve management and build innovative cooperative practices centred on complex patients in an approach of management by processes (quality and traceability).

3. SHARING VERY SENSITIVE DATA

3.1 The Specificity of the Health Data

We must integrate the specificity of the Health data. Health and medical patients' data is uniquely personal, and demands rigorous measures of confidentiality (privacy). It is subject to restrictive legislations, such as the "Health Insurance Portability and Accountability Act" (HIPAA) in the United States, that of the "*Commission Nationale de l'Informatique et des Libertés*" (CNIL) in France in conformity with European Union directives, or the "*Commission d'Accès à l'Information*" in Quebec (Canada).

Such legislations try to ensure property, access, storage and responsibility in using patient's data. Solutions are different according to national contexts. Sometimes conflicts arise between different legislation measures, such as those between some States in the USA and the American Federal Government (Bourret, 2004).

3.2 An Imperative: Sharing Data

According to Grimson et al. (2000): "The present inability to share information across systems and between care organizations...represents one of the major impediments to progress toward shared care and cost containment". Improving the Healthcare system depends on uses of health data at three different levels: macro (governance: national State or regional level), meso (hospitals or interface organizations), and micro levels (doctors and patients).

In times of limited financial means and with huge deficits, at the national State or regional level, "efficiency" and "performance" have become essential. The difficulty here lies in mastering costs and allotting resources to the meso and micro levels. Hospitals need to adopt a new pricing system known as "tariffs according to the activity" (T2A or *Tarification à l'Activité*). This new system would result in a better allocation of resources. There is also a strengthening of certification policies and contracts with hospitals. Data is also required for watching, for results analysis, goal assessment, and for the evaluation of health professionals' practices, both at the individual and collective levels (*Haute Autorité de Santé*).

3.3 The Craze for the Patients Health Medical Records

At the micro level, very mediatized since 2004, the *Dossier Médical Personnel* (DMP) or Personal Medical Record was presented as an almost magic tool, introducing great changes in doctor-patient's relations. It was expected to ensure traceability, coordination, transparency and quality of care. It belongs to the patients themselves: they decide who has access to it. The DMP was also presented as a valuable opportunity for cooperation between the private and the public sectors. But at the end of 2008 things have now changed: DMP is no longer compulsory and its implementation is delayed. Federative and more limited projects are developed such as in the *Assistance Publique-Hôpitaux de Paris* (AP-HP). There is also a pharmaceutical record (*dossier pharmaceutique*). Its experiment is more successful. Almost two million pharmaceutical records had been opened on December 1st, 2008 in 4900 chemist's shops. We have also specific cancer record and all the records of intermediary organizations.

The implementation of a national Electronic Health Record (EHR) was also a priority for the British National Health Service (NHS). It aimed to establish a record for life (e.g. the ERDIP project: Electronic Record Development and Implementation Programme). The Electronic Health Record should be operational in 2008. It is not the case. In Spain, the Autonomous Community of Andalusia tried out the *historia sanitaria* or Diraya project for all the people of Andalusia.

In May 2004, a new office was created in the US Ministry of Health: the National Health Information Technology Coordination. All US citizens are concerned by a standardized health record planned for 2010. The main US Health Maintenance Organization (HMO) Kaiser Permanente (20,000 physicians, 8 million patients) highlighted the electronic medical record as the central element of a policy to improve the quality and efficiency of care.

EHR experimentations face common problems. Such problems include management and data storage, financial problems (i.e. who pays?), project management problems or delay resting on essential legal aspects. The road will be longer than expected. We must also consider linking EHR and national Health or Health Insurance cards, such as the Vitale card in France or the European card (implementation decided in 2002). Here too, we face the problem of working across frontiers (States), since Health policy remains a national governments' field and not a European one.

4. MASTERING THE SAME CHALLENGES: INTEROPERABILITY AND A GLOBAL APPROACH TO COMPLEX SYSTEMS

4.1 A more Global Approach

If EHR were considered as a key enabler for eHealth (Villac, 2004), they must be integrated in Information Systems (Fieschi, 2003). It is the case in the USA with the NHIN (National Health Information Network) project.

What is the best level of building Information Systems in France? The Fieschi's report (2003) suggests that the regional level would be most suitable. In France, we must also quote the *Réseau Santé Social*, a technological network for transferring reimbursement data (paying back). This network manages electronic sheets, or *feuilles de soins électroniques*, specific to the French system of upfront "payment by act", with patients subsequently reimbursed by Health Insurance (a system dating back to 1927). Care quality can also be improved through the SNIIR-AM, or *Système d'Information Inter Régimes de l'Assurance Maladie* one of the most important data warehouses in the world. The *Web médecin* – used to check doctors' prescriptions – can also strengthen care quality by recording exactly what drugs the patient takes.

While different responses exist at national levels, the main goal is to overcome the obstacle of excessive compartmentalization. In the end, most of the considered challenges are roughly the same. They include data property, data access and management of access authorizations (the issues of identifications and of shared medical secrecy / privacy), doctors' collective and individual responsibility, the appropriate level of data storage and data management. The main imperative is to achieve interoperability of both tools and data. As Moore and Fuchs pointed out, there is also an important conflict between individual and collective goals.

J. Van der Lei (2002) stressed that "applying information and communication technology (ICT) to a medical domain is not merely adding a new technique, it radically changes processes in that domain". He highlighted the necessity of analyzing "feedback mechanisms". ICT have an impact on the attitudes of patients. They change traditional information asymmetries between patients and doctors. Better informed, patients have now become far more demanding than before, more insistent on flawless procedures, and more demanding to their rights. L. Sfez (2001) speaks about "the utopia of perfect health" – a "utopia" in which these demanding patients ask for increasingly formalized and contractual results. ICT have also changed medical practices, which has in turn influenced the evolution of technologies themselves. D. Sicard talks about "medicine without the body" (2002). All these changes lie at the heart of our constructivist approach to understand complex systems: to analyze the development of social practices in the long run.

4.2 Two Interconnected Imperatives: Quality and Mastering Costs

In France henceforth the costs of compartmentalization are assimilated to "not quality", some estimate them even at 10 or 15 % of the budget of the Health Insurance.

In "Quality Imperative" (2001), Kimberly and Minvielle outlined the technical dimension of quality: guidelines, assessment (evaluation) of outcomes and evidence-based medicine, the process dimension of the quality considered as an "important social good".

The importance of compartmentalization in France depending on specific factors: weight of hospital sector (hospitalo-centrism), choice of private (liberal) primary care with no subordinate links to Health Insurance in the 1930s etc., corresponds to a strong deficit of intermediary organizations especially between primary care and hospitals (public or private: clinics). The awareness of this problem implied innovative responses.

4.3 The Main Challenge of Interoperability

Both industrial, national governments and European Union are aware about the main challenge of interoperability. In France, a new agency: ASIP (*Agence pour les Systèmes d'Information Partagés* or Agency for Shared Information Systems) should be created in 2009. We must point out the lobbying role of the LESISS (*Les Entreprises des Systèmes d'Information Sanitaires et Sociaux* or Companies of Sanitary and Social Information Systems). At the European level, there exist IHE (Integrating the Healthcare Enterprise) an initiative of the healthcare professionals and industry to improve the way computer systems in healthcare share information. IHE promotes the coordinated uses of established standards such as DICOM and HL7 to address specific clinical needs in support of optimal patient care.

At European Union level, eHealth policy has been also set out in the 2004 eHealth action plan, which sets out a road map for this sector, with the steps needed for widespread adoption of eHealth technologies within 2010. The European Commission focused on improving interoperability between eHealth services and tools, and following widespread consultations with Member States and experts in the field the Commission established a set of guidelines on European eHealth interoperability, the "Commission Recommendation on cross-border interoperability of electronic health record systems" (2008), as a follow-up to the Community eHealth Action Plan which, in 2004, defined interoperability of Electronic Health Records as one of the priorities for Member States in the roadmap annexed to the Action Plan.

5. THE IMPERATIVE OF INTERFACE ORGANIZATIONS

5.1 Innovative and Integrated Organizations

Networked organizations represent significant examples of complex systems. According to Morin and Le Moigne (2003), "complexity" can be analyzed through "dialogic" (double-logic) couples. "Dialogic" refers to "logics" that were traditionally considered opposites, but that are now managed as complementary pairs. Some examples of dialogical pairs are: order/disorder, individual/ collective, local/global, autonomy/centralisation, or public/private.

In terms of "complexity" or global approach of the French Health System, Healthcare Networks or *réseaux de santé* represent a first innovative response. These Healthcare Networks developed in the middle of the 1980's following two different approaches. First, facing the AIDS epidemic, some primary care professionals tested new practices of coordination between primary care, hospitals and chemists. These innovative coordinations became the first approach to Healthcare Networks. The second approach concerns managers wishing to adopt the methods of American Managed Care HMOs (Health Maintenance Organizations) in order to control costs better by mastering traceability of care and medical prescriptions (treatment). In this case, we talk about Coordinated Care Networks (*réseaux de soins coordonnés*). The April 1996 government's edict favoured the experimentation of these managed care networks, allowing tariff innovations.

The World Health Organization (WHO) explained that Health is larger than mere cure, since it also includes quality of life as well as the social dimension of well-being. Since the end of 2002, a new global financing of Healthcare Networks exists, globally financing fields (primary care and hospital activities) separately financed before. We now refer to global Healthcare Networks (*réseaux de santé*). They are roughly 1000, including 100 000 to 150 000 patients.

But in the perspective of construction of intermediary organizations between primary care and hospitals, Healthcare Networks are no longer alone. They are in competition with multidisciplinary healthcare homes (*maisons de santé pluridisciplinaires*) including general practitioners, nurses, physiotherapists and poles of ambulatory health (*pôles de santé ambulatoire*). We can also find hospital organization at home (*hospitalisation à domicile: HAD*).

5.2 “Holographic” Organizations

All these new interface organizations constitute “holographic” organizations (Shortell and al. 1996) or “*organisations hologrammatiques*” (Morin and Le Moigne, 2003). For Shortell, such an organization is not merely the sum of its parts, but exists within each individual part. Shortell claims that “holography is the antidote to excessive fragmentation and specialization”. The essence of the holographic organization (complexity) lies in its ability to embed the “whole” in each “part”. Thus, the goal consists in working as “holistically” as possible in terms of knowledge, expertise, and information transfer. These “holographic” organizations resting on new information uses and communication’s interactions are also “training” or “learning” organizations.

Developed countries share common challenges: developing links for building communities of services by using a global approach to Health. This global approach must be achieved in a perspective of management of complexity, based on the coordination of public and private actors. The essential aim is the management of complexity to create trust between different actors. This trust should generate a group-oriented culture (collective identity) and develop more efficient, integrated, and quality-driven organizations, or what Shortell calls “building community”. In France, we must cope with twin challenges: developing both an information and an evaluation (assessment) culture.

Firstly, health professionals must meet, know each other and work together. Then, they must learn to exchange information. Finally, they must learn to produce information together. The most difficult step is accepting the judgement of others with regard to highly individual practices, doing so requiring a great change of mentalities. Constructing collectively shared practices will take time. Trust is essential: trust takes a long time to be built but a short time to be destroyed.

These intermediary organizations rest on coordination practices and traceability and interoperability goals that is to say the value added of their Information System.

6. STAKES CONVERGING ON THE DEVELOPMENT OF REGIONAL INFORMATION AND COMMUNICATION SYSTEMS AND EVALUATION CHALLENGES

6.1 Regional Health Information and Communication System (RHICS)

Everything is connected. S. Shortell, S. Glouberman and H. Mintzberg, M. Durampart and B. Guyot among others insisted on the convergence of all the stakes on the reliability of the Information Systems. Their development constitute a major stake to improve the coordination of all the Health System. For Glouberman and Mintzberg, “the development of appropriate levels of integration in the system of healthcare and disease cure will require stronger collective culture and enhanced communication among key actors”. For S. Shortell and al., the determining aim is “building delivery systems”.

Actually, Information Systems produce representations of the organization which they structure besides. M. Durampart and B. Guyot suggested (2008) questioning the organization in the light of Information Systems. It means articulating information and communication, articulating ICT and processes. The Information System is a revelation of the limits or the impasses of the change.

For the French thinkers or the “Sociology of the Traduction”, M. Akrich, M. Callon and B. Latour, the technical devices, in our case, Information Systems (IS), constitute “complete actors”. In his “Sociology of the Network Actor” (SAR: *Sociologie de l’Acteur Réseau*), M. Callon mentions “hybrid collectives”, and defines the originality of the SAR by “the role which it assigns to the not human actors in the constitution of our society” (2006).

We must have a wide vision of Information Systems. A global IS can corresponds to: 1) a portal of information, but opened to whom: patients or only professionals? 2) a platform of services: with guides of good practices 3) a system of hosting of individual data as for example those of the DMP 4) a system of collection of data in particular for the evaluation of the activities of the organizations and for sanitary watching. They also integrate human aspects (interactions between all the users).

For the Healthcare Networks, constituting above all spaces of experiment of new modes of functioning, T. Ficatier (2008), talks about "IS of coordination of care". IS are levers for performance. They have to coordinate the activities, interconnecting the producers of care and services around the information relative to the sick person. It is a question of producing communicating IS between primary care and hospitals (essential stakes in interoperability) to facilitate the coordination between the actors of the patients' global care by contributing to the creation of value. These coordination's IS have to contribute to the development of a platform of proximity services around the regular General Practitioner to ensure the function of regulation better (avoid as much as possible the passage in the services of emergencies of the hospitals), and the function of first appeal by directing as well as possible the user.

The GMSIH (*Groupeement pour la Modernisation des Systèmes d'Information Hospitaliers*), in a next future integrated in the new Agency ASIP, analyzed (through survey about 10 % of the existing Healthcare Networks) the information flow of the Healthcare Networks situated in a process of urbanization, grouping together information flows in 3 big functional blocks: 1) knowing: identification of the patient, the directories, the protocols, the data of public health; 2) coordinating: information, orientation, global and coordinated care 3) global piloting: evaluation of the activity. For T. Ficatier, an approach by needs is essential, it is an issue of defining a geographical framework for this coordination, IS constituent above all territorial and proximity IS.

Their IS as more widely the development of the Healthcare Networks are to be considered in terms of organization of collaborative strategies. IS of Healthcare Networks must manage the global coverage becoming the unique gate integrated into platforms of services very probably at the regional level.

The dispersion of the actors and of their responsibilities is often criticized. These IS must be replaced within the framework of the institutional changes which should soon modify the context of their activity. The creation of Regional Agencies of Health (*ARS: Agences Régionales de Santé*) and no more only the Hospitalization Agency (ARH) should constitute the key measure of the law of renovation of the Health System renamed "Hospital, patients, health and territories " (2009). These new ARS will rest on RHICS: Regional Health Information and Communication Systems. The key issue becomes: what efficient information tools to ensure the success of the ARS?

Two new agencies should be created by grouping together the various public actors: an ASIP (Agency of the Shared Information Systems of Health) including the GIP-DMP, GIE-CPS (*Carte des Professionnels de Santé*), and another part of the GMSIH with other organizations in an ANAP (*Agence Nationale d'Appui à la Performance des établissements de santé et médico-sociaux*) with at once the question of demarcation between their skills ... Why not a single agency?

As soon as 2000, J. Oates and H. Bjerregaard Jensen have pointed out the imperative of building regional Health Care Networks in Europe to connect primary care, pharmacy, laboratory and diagnostics, specialists, hospital and home care. In France, this point of view has been developed in 2003 in the Fieschi's report. Interesting experimental realizations developed in the continuation of the Fieschi's report as for example in the Franche-Comté region, where the ARH (Regional Agency of the Hospitalization) in partnership with other public regional organizations set up a regional portal with in particular a common base (corresponding to a shared minimum medical record), a pivot block for the information exchanges with a shared server to identify patient's identity, and reports of hospitalization homogenized. The interoperability of the applications is assured.

Since the beginning of 2008, the Ministry of Health and the hospitals of Paris' region work on the implementation of a shared experiment for Information Systems of Healthcare Networks in Ile-de-France (R.MES project). This Information System will ensure coordination's tools and will propose modules of management of the administrative and medical data of the patients. It will integrate a secure electronic mail and will be compatible with the standards of Personal Electronic Health Record (French DMP) and Cancer Communicating Record (DCC).

6.2 The Evaluation as a Quality Approach of IS and the Management of the Change

Our experience of evaluation of Healthcare Networks showed us that the essential stake is indeed to create a culture of sharing the information resting on trust and the will to work together. It is not only the technical value of the IS that is essential but its capacity to federate the actors, to translate in the best way their

activities in a perspective of quality approach. As such their development is inseparable from stakes in the evaluation, henceforth conceived as a progressive improvement and driving change.

The evaluation of the added value and the efficiency of the activity of the Healthcare Networks become compulsory. A circular of March, 2007 points its objectives and its frame. The evaluation of Healthcare Networks is above all that of the coordination of their activities: so it is mainly that of their Information System. It has to outline the involvement of all the actors (including patients) notably in the construction of the collective identity of the networked organization. In this perspective, the IS naturally has to supply reliable, relevant and updated data. It also has to help in the convergence of the various representations of the actors.

6.3 RHICS and Territorial Intelligence

We already mentioned that the law of renovation of the French Health System was renamed "Hospital, Patients, Health and Territories". With the planned creation of the ARS (2009), the "territorialization" of the management of the Health will enter a new phase. It began, contrary to the other countries as Germany, Spain, Italy or Scandinavian countries, rather late in France: creation of the ARH and the URCAM (*Unions Régionales des Caisses d'Assurance Maladie*) in 1996.

All the mentioned organizations of interface of primary care: Healthcare Networks, but also multidisciplinary healthcare homes, poles of ambulatory health or organizations of hospital at home or, for the hospitalization, the hospital communities of territories (*communautés hospitalières de territoires* cf Larcher's report) have to find their place in the Regional Plans of Sanitary Organization or SROS (*Schémas Régionaux d'Organisation Sanitaire*). The "territorialization" of the management of the Health is inseparable from the uses of new ICT tools, stakeholders of generalized IS or RHICS. This new approach of the Health may be considered as an aspect of a global process of Territorial Intelligence, the RHICS being also Geographical Information Systems (GIS).

But all these perspectives rest on the development of the implication of all the actors, institutions, health professionals, Information System companies, and of course, patients, to create a sanitary democracy (*démocratie sanitaire*). Building trust is essential. G. Le Cardinal, J.-F. Guyonnet and B. Pouzoullic (2003) showed that in the complex projects, cooperation must be built by the institution of a reliable climate between all the stakeholders. They suggest beginning to establish it by gathering them in a workshop of creativity around the method PAT Miroir (*Peurs, Attraits de la coopération, Tentations, en Miroir*) in english FIT Mirror (Fears, Interests for cooperation, Temptations, in Mirror). This process analyzes the differences and builds trust between the participants on a long term basis, while building at the same time a common representation of the project of Information System and giving consensual recommendations.

Rather paradoxically, an example of successful modernization of a public Health System by leaning on efficient Information Systems and regionalization of the management of the Healthcare came from the United States as showed D. Silber (2007) with the example of the VHA (Veterans Health Administration) or the Health System of the war veterans. While the VHA was almost beginning to suffer the agony at the beginning of 1990s, it became a model, unlike many HMOs, henceforth very criticized, notably for the rationing of the care. According to D. Silber, the success of the VHA is due to a real management of project of change, to a performance evaluation, to a regionalization of the responsibilities around objectives of improvement, to a teamwork in primary care. It is the Information System which made possible the coordination and supplied data for the piloting and the evaluation.

7. CONCLUSION

In developed countries new uses of information are at the heart of important changes in managing the Healthcare Systems. The challenge is particularly strong in France where individualistic mind-sets and compartmentalization are very weighty. So building new intermediary organizations such as Healthcare Networks may be a very important means of developing trust, both in technological tools (e.g. RHICS) and in human cooperation.

But Information Systems are not the end in itself. They only constitute a tool to improve the efficiency of the Healthcare System and the quality of services to the patients who have become “empowered” actors, responsible for their own health.

As any technique, ICT are ambivalent (Ellul, Musso). They can be at the same time levers of improvement of the performance (traceability and information sharing) or tools of control and stubborn measure of the performance only seen as quantitative. H. Mintzberg denounced these drifts: “remark on a very naughty word: efficiency ” (2001).

In an other work, Glouberman and Mintzberg (2001) pointed the goal “beyond markets and hierarchies: reconnecting care, cure, control and community”. For them, “All across the society we need more informed community, more nuanced control, better connected cure and more fortified care”. IS are imperative tools but they are only tools. Always for Glouberman and Mintzberg “collaboration is more important than competition and control”. The challenge is developing collaborative management resting on coordination and collaborative networks.

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AN IMAGE RETRIEVAL SYSTEM FOR THREE-DIMENSIONAL TRADEMARK

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ABSTRACT

Nowadays, the quantity and the variety of registered trademarks rise rapidly. How to rapidly search and classify the trademark as the value of intellectual property right is very concerned by people. Therefore, we need to have a rapid retrieval strategy. In the traditional image database search, it usually uses the text description to search for the trademark. However, the trademark design and style is more and more complex. If only the text description search method was used, it would be inefficient. Thus, the trademark retrieval system must use the content of the trademark image itself and use its' automatic classification and matching process. In this paper, it is aimed at the three-dimensional trademark image and proposed an efficient search method for three-dimensional trademark images. Experimental results show very good retrieval accuracy on a three-dimensional trademark for the image database from the website of Intellectual Property Bureau, Ministry of Economic Affairs, R.O.C.

KEYWORDS

Harris corner detected, Three-dimensional trademark, Image retrieval system.

1. INTRODUCTION

With the advent of digital multimedia era, many multimedia products like digital camera and cell phone, etc. are manufactured. These products were used by people widely, so it will increase large number of digital images. It is currently important research issue to find out how to process these large numbers of digital images and fast search. Therefore, the development of the image research technique is necessary, among which content-based image retrieval (CBIR) technique has been a major topic of research in the recent. It retrieves images based on visual feature such as color, shape, texture, spatial layout or a combination of two or more such features.

The corner detector is one of the important partial features in the image feature. It recognizes the shape of the object from the image. At present, there are three ways of corner detector: (1) Based on the selection from edge feature of the image [9], (2) Using the gray image for corner detector [6]. (3) Based on parameter model [1]. The most common way is gray image because it will not be influenced by the angle and the light. Among which Harris corner detector is most well-known [6]. Its major purpose is to compute gradient of pixel position for detecting corner. If both directions of x-axis and y-axis are change huge in gradient of image pixel position. Namely, this pixel point is a corner.

In this paper we hope to find a fast way to search for three-dimensional trademark because of the value of intellectual property right is very concerned by people, whether it is at domestic or international. How to design a unique trademark is a very important issue nowadays. Intellectual Property office, Ministry of Economic Affairs, R.O.C. accepted text trademarks, pattern trademarks, three-dimensional trademarks, color trademarks and sound trademarks. Along with quantities and variety of registered trademarks rise rapidly, we need to have a fast search and classifying method. In the traditional image database search, it usually uses classification and text description to search for the trademark. However, the trademark design and style are more and more complex. If only the text description search method was used, it would be inefficient. Thus, the trademark retrieval system must use the content of the trademark image itself to classify and match automatically. The present researches only focus on text, pattern and two-dimensional trademarks, and already have proposed related research. Therefore, this paper is aim at three-dimensional trademarks.

According to the regulation of trademark laws in clause 1 of treaty 5, the definition of three-dimensional trademark is “a three-dimensional shape which has the length, width and height is an object in the three dimensional spaces.” Trademark can provide consumer to distinguish merchandises, merchandise packing, design of service place decorated, or even related text, image or color combined with three-dimensional shape of object, etc. It all can be the concept to design three-dimensional trademarks.

In this few years, there are many scholars have been proposed various feature extracted ways to search the trademark. Cortelazzo et al. in earlier period have been proposed using a link code matching technique for trademark shape description method [4]. According to edge track all series of edge points were found out and represented by string for similarity measures of link code. Eakins et al. proposed using curvature-based feature with the ARTISAN (automatic retrieval of trademark images by shape analysis) system for retrieval of trademark images [5]. Jain et al. proposed a two-level hierarchical trademark retrieval system. In the first stage a histogram of the edge directions and moments were used to rapidly filter the database. In the second stage the system used a deformable template matching [7]. Min-ta Chang et al. proposed deformed trademark retrieval method based on two-dimensional pseudo-hidden Markov model 0. Hui Jang et al. proposed based on the five holistic properties of Gestalt principle, the first saliency is based on Zernike moments, while the others are modeled by geometric feature extracted illusively for trademark retrieval [8]. From the current literature we can find out the present research focus on recognizing two-dimensional trademarks. Therefore, in this paper we aim at three-dimensional trademark images from website of Intellectual Property Bureau, Ministry of Economic Affairs, R.O.C. and propose an efficient and precise retrieval system for 3d-dimensional trademark image.

The structure of this paper is as follows: in Section 2, we describe the related technique of Harris corner detector and the concept for three-dimensional trademark registration. Section 3 explains how to compute similarity measurement for sets of three-dimension trademark images. We present the experimental results and discussion in Section 4. The paper concludes in Section 5.

2. RELATED WORKS

How to manage the three-dimensional trademark database for helping the registration process is an import issue. We will describe the concept for three-dimensional trademark and the related technology for our retrieval system in this section.

2.1 The Three-dimensional Trademark Registration

According to the regulation of trademark laws in clause 1 of treaty 5, a three-dimensional shape can be used as trademark registration. The definition of three-dimensional is “a three-dimensional shape which has the length, width and height is an object in three dimensional spaces.” Trademark can provide related consumer to distinguish different trademark for merchandise or service source”.

The main difference between the three-dimensional trademark and two-dimensional trademark is the former has the specialty of three dimensions objects. Therefore, in the registering three-dimensional trademark the applicant labels the trademark of length, width and height and attaches less than six photos or samples, which are with standard size around 5-8 cm, taken by different captured angles for definitely expressing the three-dimensional shape. An example is shown in Fig.1.



Figure 1. A case of perfume bottle for three-dimensional trademark.

While three-dimension trademark is applying for register, the characteristic of three-dimensions (length, width and height) and the identification for the merchandise both need to be considered. Generally speaking, the trademark for the merchandise of the more expensive, professional or enduring wealth, such as high technology or medicine products, got more notice. Therefore attention on the three-dimensional shape at

those products will be increased. It conducts the opportunities to register for those merchandises will be more. Contrarily, the consumers give less attention on items which have cheaper price, or merchandises for usual articles and non-uniform enduring wealth. For example, people do not pay that much attention on soap, etc., its attraction to the people is lower. Consumers would have more impression on the merchandises unless the three-dimensional shape is very unique and arrestive. According to the cognition, only when the merchandise or service source wants to distinguish the marking, then it registers for the three-dimensional trademark.

2.2 Harris Corner Detection

Harris C and Stephens M proposed Harris corner detection by improvement in the weakness of Moravec's corner detector functions [9]. Moravec's corner detector designed a local detector window in the image and observed the changes of average strength quantity in window image that shifted by a small step in various directions. Shortcoming of Moravec's corner detector function is only to detect the changes of strength quantity in window image that has eight directions. It is sensitive in isolation pixels and noises. So it can't accurately detect all corners.

However, Harris corner detector can accurately distinguish from edge and corner by considering the difference of the corner score with respect to direct direction instead of using shifted patches. It also used the difference to define the strength changing function in gradient with a Gaussian function by using a circular window to smooth image, then found the corners. Thus, it can effect anti-rotation and anti-noisy.

The Harris corner detector can distinguish respectively from flat, edge and corner in each image. Where I_x is x-axis and I_y is y-axis of image strength, and the explanations are given as follows:

- 1 . If both the horizontal and vertical strength are small change, the intensity in windowed region is approximately constant in all shifts, so this pixel is called flat. Namely, I_x and I_y are small change.
- 2 . If one of horizontal or vertical strength is high and the other is small change, then only local shifts in one direction have little change. So this pixel is called edge. Namely, either I_x or I_y is high change.
- 3 . If both horizontal and vertical strength are high changes, then the intensity in windowed region increases significantly in any direction shifts, so this pixel is called corner. Namely, I_x and I_y are high change.

3. THE THREE-DIMENSIONAL TRADEMARK RETRIEVAL

Nowadays, the quantities and the variety of registered trademarks rise rapidly, whether it is at domestic or international. How to rapidly search and classify the trademark as the value of intellectual property right is very concerned by people. Therefore, we need to have a rapid retrieval strategy. The major difference between two-dimension and three-dimension is there is a set of images from different captured angles for a trademark. We will propose a method can deal with a set of images retrieval. First, we use Harris corner detection to extract the images corners. The corner feature is an important feature for the objects captured from different angles. Second, we propose similarity retrieval for a set of images.

3.1 Feature Extraction For Image

First, we use Harris corner detector functions propose by Harris and Stephens in 1998 [9] to extract corners form each image. We find all possible interesting corner points in a three-dimensional trademark are shown in Fig. 2.

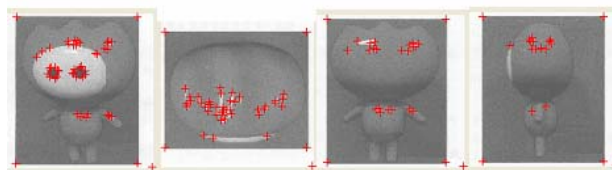


Figure 2. The corner points of images from four captured angles

To avoid the translation of object in an image, we record the distances form corners to the center of corners. The formula for corner center (C_x, C_y) is formulated as following:

$$C_x = \frac{\sum_{j=1}^k x_j}{k}, \quad C_y = \frac{\sum_{j=1}^k y_j}{k}$$

Where (x_j, y_j) is coordinates for corner j and k is total corner points number. The red point in each image shows the position of corner center in Fig. 3.

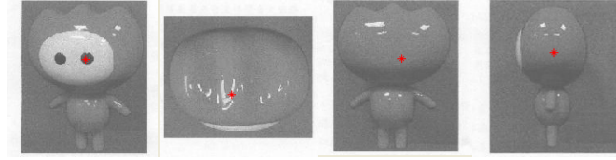


Figure 3. Position of corner center

To uniform the size factor, the Euclidian distance form corner points to center are normalized between 0 and 1. The Euclidian distance function is defined as following:

$$d_j = \sqrt{(x_j - C_x)^2 + (y_j - C_y)^2}$$

where (x_j, y_j) is the coordinates for corner j and (C_x, C_y) is coordinates for the center, where $j=1,2,\dots,k$.

The feature for each image is represented as a histogram vector (h_1, h_2, \dots, h_t) . The histogram is the results of distance quantization to t bins. In Fig.4, the bin number is 11, that is $t=11$ and interval is 0.1. The histogram vector for Fig. 5(a) is $(h_1, h_2, \dots, h_t)=(3,6,11,13,9,1,0,2,0,2,1)$, that is three corner points in the first bin and six in second bin. It means there are three corner points that distance from center are less than 0.1, six corners that distance are between 0.1 and 0.2.

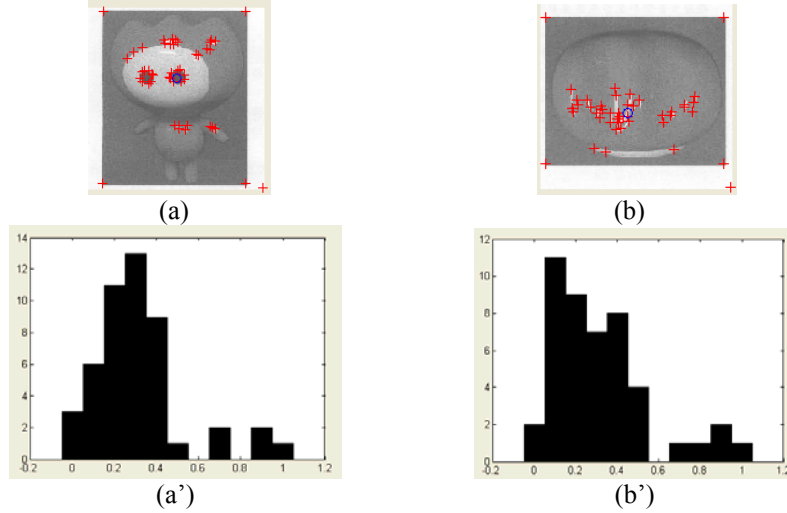


Figure 4. (a),(b) Images with corner features. (a'),(b') Corresponding histogram vectors of two images

3.2 Similarity Measure

A three-dimensional trademark will have images of different captured angles. It is major different from the two-dimensional trademark which only has one image from one angle. Each three-dimensional trademark has a set of images. Therefore, our method will provide similarity measurement of two sets images. Let n be the number of images in a set, that is n images in a trademark. From previous section description, each image has

its own histogram vector. A set of images is represented by the center of n histogram vector. Let μ_i be the center of i histogram vector in set S and formulated as following:

$$H^i = (H_1^i, H_2^i, \dots, H_t^i) = \left(\frac{\sum_{i=1}^n h_1^i}{n}, \frac{\sum_{i=1}^n h_2^i}{n}, \dots, \frac{\sum_{i=1}^n h_t^i}{n} \right)$$

The similarity measurement between two sets H^i and H^j is defined as:

$$S(H^i, H^j) = \frac{\sum_{l=1}^L \min(H_l^i, H_l^j)}{\sum_{l=1}^L \max(H_l^i, H_l^j)}$$

The value of $S(H^i, H^j)$ is more near 1 represents two sets are more similar.

4. EXPERIMENTAL RESULTS

In our experiments, fifty sets three-dimensional trademarks were downloaded from a Ministry of Economic Affairs property bureau web site [10]. One set has four pieces that is captured from four differently shoot angles, respectively. Each set of images has seven angles rotation, respectively, 45 degree, 90 degree, 135 degree, 180 degree, 225 degree, 270 degree, and 315 degree. Hence the number of relevant images in the database is eight. Totally, we have 1600 images in 50 sets. Fig. 5 shows some of them.

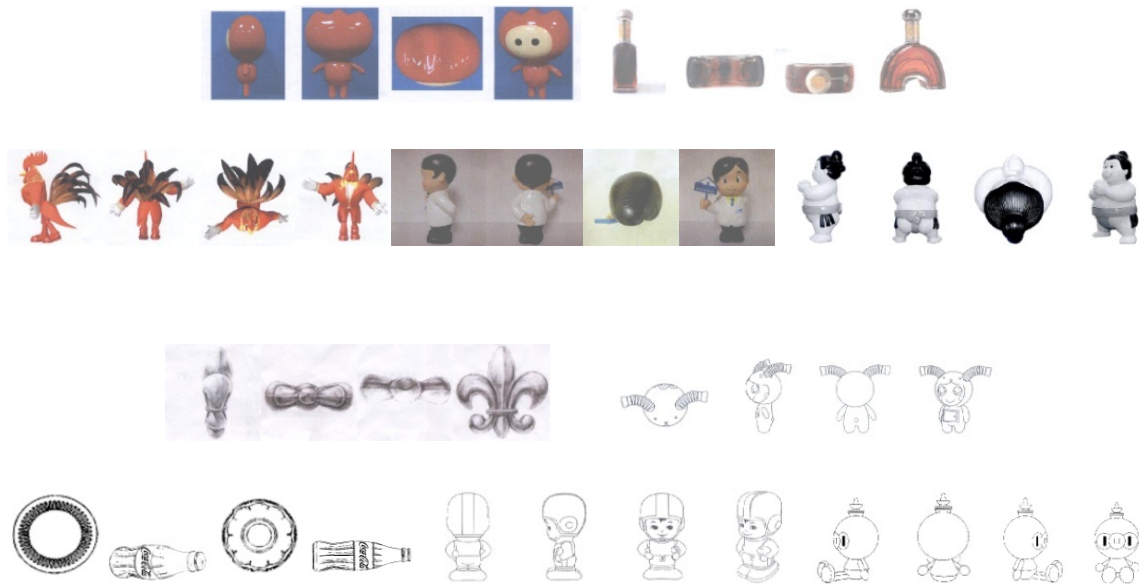


Figure 5. Partial experimental images

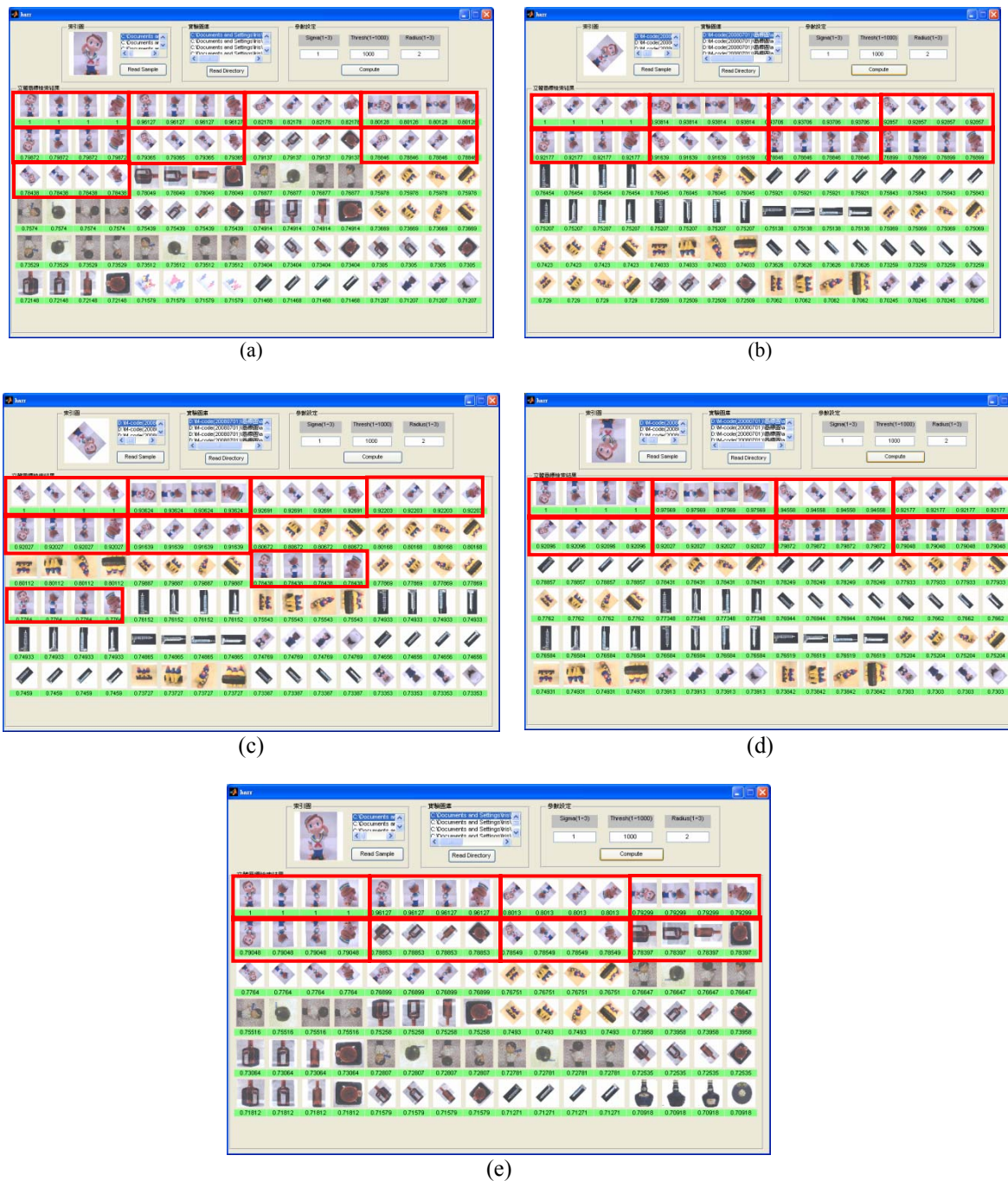


Figure 6. Retrieval results for different query. (a) Original query, (b) 45 degree query, (c) 135 degree query, (d) 180 degree query, (e) 270 degree query.

According to Fig. 6 shows the model has great retrieval accuracy. The set of query and seven sets of different rotate angle as 45 degree, 90 degree, 135 degree, 180 degree, 225 degree, 270 degree, and 315 degree are more similar than others. Therefore, our proposed method is very efficient for three-dimensional trademarks.

We subsequently computed the retrieval efficiency using the benchmarks such as recall and precision 0 for evaluating the performance of the proposed method. For a given query picture, let a be the number of all

relevant pictures, b be the number of pictures that are relevant and retrieved, and c be the number of pictures retrieved. Evaluation standards recall and precision are defined as following.

$$Precision = \frac{b}{c}$$

$$Recall = \frac{b}{a}$$

In our experiments, there are eight relevant sets for each trademark in the database, that is $a=8$. We assigned the number of retrieved sets as eight, that is $c=8$. Hence the precision and recall have the same values in Table 1.

Table 1. Average precision/recall ratio for five cases

Kinds Angles	Photo	Drawing
Original	0.8317	0.9375
45 degree	0.8606	0.9010
135 degree	0.8365	0.9010
180 degree	0.8606	0.9479
270 degree	0.7933	0.9167
Average	0.83654	0.92082

There are two kinds of trademarks in the database. One kind is photo of object. The other is drawing. We evaluated the average precision and recall ratio for these two kinds as shown in Table1. There are totally five query cases in our experiment, original, rotate 45 degree, 135 degree, 180 degree, 270 degree, respectively. Each has 50 queries. Table 1 shows the average precision and recall values for five cases. We find the proposed technique performs very well and yield a very good accuracy in different rotate angle query.

5. CONCLUSION

The three-dimensional trademark has different captured angles images while the two-dimensional trademark only has one angle. So a three-dimension trademark has more than one image in nature. Therefore, we proposed a new similarity measurement for sets of images. This method measures for two sets instead of two images. The experimental results show our method is efficient. We use corner feature only in our method. However, our method can easy to include others features. In the future, we will adapt more useful features for three-dimensional trademark image database.

ACKNOWLEDGEMENT

Thanks for the reviewers making many valuable suggestions and comments for us. This work was supported by National Science Council under Grant NSC 97-2218-E-324-004.

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MARKET ANALYSIS OF PRESENCE TECHNOLOGIES AND APPLICATIONS: AN UPDATE

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ABSTRACT

This paper focuses on an extensive market analysis done under the framework of the Peach coordination action, a project funded by the European Union Future Emerging Technologies unit. The analysis identifies, classifies, reports and further elaborates on which areas presently benefit from Presence technologies. Taxonomy of these markets is also derived in this document, describing how and why Presence is used there. Finally some data are extrapolated, showing which are the most addressed markets and which Presence technologies are the most exploited. The presented results are based on an extensive search performed on companies that have currently adopted or are producing Presence solutions. The identification of these companies is based on the support of the Peach Presence research community, and general media, and constitutes an update to previously released works. Some future applications for Presence are also proposed as the result of some panel activities in the Presence research community.

KEYWORDS

Presence, social presence, market, industry, application, technology.

1. INTRODUCTION

Presence¹ has been researched for years in universities and government labs, but because of the enormous computing power demands and associated high costs, applications have been slow to migrate from the research world to industrial areas. Nevertheless, technical issues and costs are not the main issues: the key question is making the technology suitable for real-life uses. Continual improvements in the price/performance ratio of related devices, however, have made Presence technology more affordable, and thus, many applications of Presence are reported in papers and the media not only on experimental level but also on industrial level.

By nature a deeply interdisciplinary field, Presence spans a wide range of subjects: from neuroscience and cognition to artificial intelligence, sensors and systems. This horizontal character makes Presence a fascinating and fertile interdisciplinary field, but it is can also stunt its growth, as researchers are scattered across disciplines and groups worldwide. A three-year long coordination activity, started in May 2006, promoting discipline connect, identity building and integration while defining future research and policy directions has thus been promoted under the framework of Peach², a project funded by the European Union

¹ In the present work we are not referring to Presence as online Internet technologies, especially developed with Instant Messaging application (see for instance documentation by IETF www.ietf.org [last access Jan 2009]), neither to their evolution to mobile applications (see for instance documentation by OMA www.openmobilealliance.org [last access Jan 2009]).

² Peach FP6 Coordination Action No 33909. URL <http://peachbit.org> [last access Jan 2009]

Future Emerging Technologies unit. The first goal of Peach is to stimulate, structure and support the research community, with special attention to the challenges associated to the interdisciplinary character of the field, and to produce visions and roadmaps to support the construction of the Presence. Secondly, because Presence research is set to produce disruptive technologies which can cause profound social impact and raise serious ethical issues, Peach will analyze the relation of Presence technologies with society (trends, ethics, legal aspects), foster the contact of researchers with the market and enhance the public understanding of Presence research and technology.

In this paper we present an overview of the application areas of Presence which can be found in the market. Nonetheless, this research does not constitute an exhaustive list in any given area, but rather is designed to highlight interesting, representative products and services.

2. METHODOLOGY

Two activities done in parallel are the core of this analysis. First, a Presence companies' database was produced by actively searching in the industry (on-line media, and Peach Presence community) from April 2007 to November 2008. Second, the industrial application areas of Presence were categorized, as the result of the former one.

The companies were logged in a Presence company list [I. Pandžić, G. Zaffiro, 2008] and a questionnaire was sent out to the companies. The questionnaire was aimed at collecting data describing the company activity on Presence; the following information was asked: brief company description, brief products and services description, company contact details, size of the company, area of competence (e.g. acoustic interfaces, artificial intelligence, signal processing, etc.), area of application (e.g. telecommunications, medical, entertainment etc.), nature of interest in Presence (e.g. producing Presence technologies, using it to enhance company's product/service, relying on Presence feelings of company's final users). However, and for different reasons, not all the companies provided feedback. In these cases, we filled in the questionnaire based on the research of the companies' profiles and websites. As a way to stimulate the reaction and participation, we also published the company list timely on Peach website [I. Pandžić, 2008], inviting the companies to contact us at any moment in order to review and update the published information.

The category of the application area structures the questionnaire whilst the result of the company list sometimes led to the change and adjustment of the taxonomy. In addition, the Presence company list also provides the raw data for statistically analysis of the market characteristics, country distribution and competence distribution, just to name some examples.

Table 1. Major sources and review statistics for the Presence Company database (updated Nov 2008)

Source	Authors' list	ISPR list	IST2006 contacts	Peach 2006who is who	Web search	Total
Accepted	34	2	15	3	91	145
Rejected	2	37	9	4	7	59
Total reviewed	35	39	24	7	98	203

Table 1 summarizes the major sources of information and the review process statistics for the Presence Company database. Companies in the Presence company list were selected if (1) they are basing their activities on one or more competences derived from disciplines included in the three pillars of Presence mentioned in [G. Ruffini et al., 2006] and/or if (2) they are working on, using or developing, one or more of the applications, technologies or services mentioned in thematic areas of Presence of the same document. The initial ideas for companies to be included in the database came from authors' knowledge, from a list compiled by ISPR (International Society for Presence Research)³, which supports academic research related to the concept of (tele)presence, from the "who-is-who" data collection activity of the Peach consortium [C. Martin-Puig, 2006], which is a Peach edited open list of researchers and experts on Presence, as well as from contacts established during the networking session on Presence organized by Peach in Helsinki within the European community supported IST 2006 Event [S. Dunne, 2006], where a number of business cards were collected and later analyzed. Later, web-based search was more focused and based on identified application areas and technologies, as well as some further personal contacts and information from other sources. Based

³ ISPR URL <http://www.temple.edu/ispr> [last access Jan 2009]

on the review of a total of 203 companies from all mentioned sources, 145 companies were retained in the current database.

Last but not the least, it is worth to mention that this activity is still in progress and modifications of the methodology may be possible in the future, which will result in updating these results accordingly. This paper, compared to previously released one [G. Zaffiro et al., 2008] extends the company list to November 2008, increasing the number of companies analyzed and slightly changing some results.

3. MARKETS FOR PRESENCE AND EXPLOITED FEATURES

Presence is a field studying the science, technology and social impact of digitally mediated interaction. It consists of research strands studying how to produce “real”-feeling experiences and the impact of new interaction technologies on social networks. Presence Science studies how the human brain constructs the model of reality and self using replacement/augmentation of sensorial data and interaction. Presence Science belongs to a wider class of research fields studying how cognitive systems build models of their environment and interact with it. The main goal of the field is to develop science and technology to achieve successful replacement/interaction (i.e., Presence, being someone, there, with others) and open up a wide range of powerful applications.

We can separate the Presence research field in the following three main areas: (1) **Human/Social cognition**: This is considered in a broad sense, including both intelligence and action, as well as emotion and volitional processes. In terms of disciplines, this spans cognitive psychology and cognitive neurosciences, social sciences, psychology of emotions, as well as cognitive anthropology and linguistics. (2) **Human-machine interfaces**: technologies to send and receive information from the human(s) to the machine agent(s). These are basically human-machine bi-directional communication gateways: displays, cameras, microphones, speakers, electrophysiological sensors, vestibular or other stimulation, odour synthesis, transcranial magnetic stimulation etc. (3) **Machine cognition**: this field involves artificial intelligence (in the widest possible sense), computational intelligence (including fuzzy logic, statistical learning, etc.), as well as large data system management, automatic classification, statistical analysis and signal processing. This aspect is perhaps less relevant in the technology mediated human-human communication scenario, but becomes critical in machine-human interaction, providing the essential “ghost in the machine”.

Among the enabling technologies of Presence, perhaps the most important one is human-machine interface. Human and machine agents each have actuators and sensors, and they are allowed for direct interfaces as well.

A non-exhaustive list of enabling technologies which are relevant to Presence have been taken in account in searching and selecting the Presence company list. These technologies can be associated to the following main competence areas: Acoustic interfaces, Brain - computer interfaces, Artificial intelligence, Augmented/mixed reality, Computer graphics, Communication technologies, Computer vision, Human - computer interaction, Haptic interfaces, Medical imagery & measurement, Signal processing, Virtual reality, Virtual humans.

Analyzing the Presence company list we derive a taxonomy which identifies eight application areas where those companies are running a business exploiting Presence technologies, and that we call here markets. The identified markets are: Architecture and construction, Entertainment, Manufacturing and Design, Marketing, Medicine, Military, Telecommunications, Training and education.

In the following sections we describe, for each market, which are the main advantages that Presence brings to the activities performed by the companies active in the corresponding application area.

Architecture and construction is an area where visualization and “immersiveness” are the main benefits coming from Presence. One application, the architectural walkthrough, is a computer-based, interactive system that can simulate the visual experience of moving through a 3D model, e.g. helping to see the impact of proposed urban designs [J. White, 2002]. Another is the 4D production modeling, which allows to view a planned construction over time on the screen and to review the planned or actual status of a project.

Entertainment is the second main application field for Presence. Entertainment benefits from Presence in changing the way we watch movies, making them interactive and immersive and enabling to meet fantasy characters within a simulated environment. Another advantage played by Presence technologies here is to enable people to interact with game context and act as if they were really in the games. Finally and recently

quite a hype, people have begun to entertain themselves via computer-based simulated environments intended for its users to inhabit and interact via avatars, i.e. Second Life and similar virtual worlds: every day millions of users visit those virtual worlds that exist as games/role play/fantasy worlds.

In **Manufacturing and design**, Presence is mainly applied to achieve the best visualization. Using virtual reality is a key to create 'virtual prototypes', or demonstrating design work (e.g. organizing a virtual fashion parade), or leveraging on virtual ergonomics to improve workplace safety and efficiency. Visualizing complex data, e.g. oil reservoirs deep in the ground, is also another effective way to keep industrial costs low [C. Lin, R. B. Loffin, T. Stark, 1998].

Marketing can benefit in several ways from Presence: visualization, virtualization, augmentation. A product can be shown via a 360-degree 3D animation even if not there. Customers can try clothes and other apparels in virtual showrooms, enabling customers to experience the products and customize for their own preferences. Advertisers can tailor ads to a specific context using virtuality. Finally virtual worlds can be a place where real people's avatars go and see real (or virtual) products and brands, and buy them in the virtual world or real one with virtual money that eventually turns to be real.

Medicine is one of the most well-known markets for Presence, as results from the analysis of the company database analyzed in this paper, where it scored the highest company's target number. Medicine benefits from Presence in several ways. Through augmented visualization it helps to expand the information available to the surgeon while operating on the patients [K. Kania, 2000]. Using immersive environments enables to treat phobias and other mental problems by taking the patient into a therapist controlled virtual experience. Using simulations or representations of individuals involved in one or more healthcare processes, it offers surgeons the chance to practice skills, techniques and critical tasks in a real-life context but in a risk-free and cost-effective way⁴.

The **Military** area focuses on the competitive advantages which especially come in augmenting human capabilities. Adopting displays enhanced with augmented reality systems helps to provide extra information to the soldiers. Moreover military forces exploit simulation-based training in the operation of various weapons and vehicles, and apply virtual environment and video-game technology to tactical training tasks and recruitment [J. White, 2005].

In **Telecommunications** video-teleconferencing or tele-presence is a typical example of how Presence helps to recreate the illusion of communicating as being in the same place. Another advantage delivered by Presence is to recreate and augment the social experience of communicating and collaborating with someone else: this brings advantages to applications in the mediated collaboration field, supporting work teams or managing shared knowledge. Telecommunications can also benefit from Social Presence [F. Biocca, C. Harms, J. Gregg, 2001, J. Hauberet et al., 2005, G. Riva, R. Schroeder, G. Zaffiro, 2008] which can add non-verbal cues [F. Martino et al., 2007, M. C. Brugnoli et al., 2006] emotions and contextual information to the standard mediated communications: this ends in developing virtual interactants or agents [M. Garau, 2003], which have some level of artificial social intelligence in dealing with real humans.

Training and education appears from the included companies analyses to be nearly as much targeted as entertainment. Here Presence is used to develop highly immersive learning tools (such as simulation, virtual reality interfaces and role playing) which enable trainees to do just what with a real experience is hard to manage and 'create'; moreover it can be exploited in education for visualizing abstract (but not only) concepts.

Analyzing how the previous markets benefit from Presence, it is possible to isolate four main features, which are extensively used: (1) **Augmented/3D visualization**, that impacts mainly on surgery, entertainment, military, marketing, manufacturing and design, architecture and construction, education. This feature relates to the capability of showing reality in a more effective way, adding useful information and cues or just allowing to visualize the "invisible"; (2) **Immersive environments**, that impact mainly on medical virtual therapy, training, virtual worlds, mediated communications. This feature fully recreates the sense of being in a place, alone or with someone else; (3) **Haptics applications**, that impact mainly on medical simulations, interactive games, robotics (tele-operation e.g. in surgery). This feature extends the perception of virtuality beyond visualization embracing the sense of touch or the sense of being operating physically on something virtual (force feedback); (4) **Social presence**, that impacts mainly on telecommunications (and more specifically to mediated communications, collaboration systems, and virtual humans), and robotics. This feature deals with the sense of being with someone else, making easy and natural

⁴ See for instance the Medicine Meets Virtual Reality conferences www.nextmed.com/mmv_r_proceedings.html [last access Jan 2009]

to communicate as in a face-to-face situation, collaborating with someone else, and even having a better and effectively understanding of a group dynamics, finally helping to give to virtual humans and robots a human behavioural flavour.

4. FUTURE APPLICATIONS FOR PRESENCE

In this section we explore future applications for Presence technologies. The method we used was to interview a panel of experts in the Presence field.

Peach is organizing several events where the Presence community, composed by experts in this area, are involved. In the last couple of years two Summer Schools and one Industry Event have taken place. During the Summer School 2 in Dubrovnik, 9-11 July 2008 (see <http://school.peachbit.org> [last access Jan 2009]) and the Industry Event in Torino, 12-13 November 2008 (see <http://industry.peachbit.org> [last access Jan 2009]), Peach proposed an interactive session where delegates were asked to discuss and envision future applications for Presence.

Proposals were added on nine posters hanged up in a meeting room. Each poster was entitled to a different market area, except one left to “other applications”. Members of the core team moderated the session and stimulated the contributions. We gathered a total of 162 ideas. Most of them (19%) appeared in the “other applications” poster, followed by “entertainment” (16%) and “medicine” (13%). The less addressed area was telecommunications (6%). In the following paragraphs we are summarizing some results.

For **Architecture and construction** most suggestions are in line with the currently existing applications to visualize architecture, to do virtual design, to predict of future urban shifts (including simulation of demolitions). Interesting proposals are (1) to see installations in the walls (tubes, cables) and (2) to make “my tiny house look like a castle”.

For **Entertainment** most proposals insist on virtually meeting celebrities (alive or not...) and to simulate human activities in the entertaining area (like games, sports, arts etc) in order to allow practicing them before playing in reality; these proposals are in fact belonging the training area. Interesting proposals are (1) to induce organic stimuli (like thirstiness, hungriness etc), (2) to create virtual hallucinations (without any chemical substances), which might give rise to strong ethical issues and (3) to generate emotionally-compelling activities which are not mimicking reality (situations that you can't create in reality).

In general panelists suggest to use Presence technologies for **Manufacturing and Design** to visualise prototypes and complex data, and virtually plan industrial plants. Two proposals differ from the mainstream: (1) to apply Presence to the 3D reconstruction of products using ultrasonic sensors and (2) to model or predict unexpected uses of products (or services).

Proposals for **Marketing** are about using Presence technologies to visualize virtual products and create interactive advertising. Some more creative proposals are (1) to create video billboards with avatars that show emotions according to what they are advertising, (2) to transport personal characteristics (e.g. Facebook.com photo) to target advertising in order to achieve sympathy (e.g. see Bailenson's TSI - Transformed Social Interaction - theory in P. Messaris et al., 2006, pages 255-259) and (3) to generate a virtual salesman with psychological feedback.

In general suggestions for **Medicine** indicate that Presence can be used in order to train medical personnel by simulating internal organs or the entire patient body and recreating virtual medical tools; other suggestions were to augment information to support treatments and procedures, and to use virtual treatments. These ideas are in fact already existing applications. Disruptive proposals are (1) to generate virtual symptoms in order to discourage certain habits, (2) to support virtual (self) hypnosis and (3) to host a live brain in a virtual body if the real one is not alive anymore.

Most suggestions for the **Military** area are in line with the currently existing applications to simulate various phases of the war, to augment information to the soldiers, and to train to use vehicles, weapons, to perform tasks etc. Interesting proposals are (1) to create pre-traumatic (instead of post) stress disorder simulators (giving trainees the worst aspects of war before they get there for real) (2) to simulate the post-battlefield and see what happens to the place and the people after and (3) to adopt psychological torture techniques for interrogation of prisoners of war.

For **Telecommunications** Presence has being proposed as the mean to be there together, cooperate, regardless of doing this between humans or virtual agents. Some proposals indicate the (ever and ever)

growing interest in generating and transporting emotions in communications. This will let us feel emotionally co-present with someone remote (especially beloved ones), or give back emotional feedback to the actors / performers during live event broadcasted to remote audience.

Quite obviously Presence can be used in **Training and education** to learn and practice how to operate tools, vehicles, perform or rehabilitate to perform tasks, playing roles. An interesting proposal is to leverage on virtual training to let people think and understand about the consequences of their own actions (e.g. bad habits and behaviors).

Some suggestions are not strictly applicable to the other market areas. Here are some of the (disruptive and sometimes even “bizarre”) proposals: (1) to enable asynchronous collaboration, (2) to use Presence technologies to investigate our brains’ capabilities (see also preface by Biocca, page vi, in G. Riva et al, 2003) e.g. as “cyclotrons for the brain”, (3) to develop virtual space travels / time travels, (4) to do (virtual) gene swapping and see what your babies are going to look like, (4) to create virtual cloning, (5) to experience new physics, new bodies, (6) to feel present with people who are no longer there, and (7) to explore and “represent” paranormal experiences.

5. MARKET ANALYSIS

We analyzed 145 companies that have been identified as either offering Presence technologies or using them in their products/services. We have analyzed the data base with respect to the companies' areas of competence, markets and geographical location.

The distribution of companies with respect to their areas of competence is presented in Figure 1. The dominance of virtual reality and computer graphics is the result of traditional view of these technologies as central for achieving presence, but to some extent also due to the fact that these companies were the best known to the researchers; it is therefore expected that with ongoing efforts in filling the data base the disproportion will become somewhat less pronounced, though most probably virtual reality will still dominate.

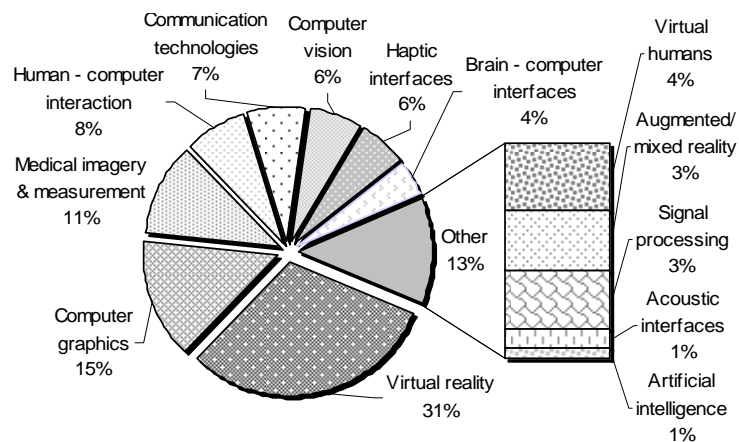


Figure 1. Distribution of Presence-related companies by areas of competence

Based on the distribution of companies by areas of competence, the companies were placed within the three pillars of Presence as identified by the Peach community [G. Ruffini et al., 2006] (Figure 2). Due to a large number of companies with competences in computer graphics and virtual reality, the human computer interaction field is the most populated. A low industrial activity may be noted in the human cognition field and its intersection with the machine cognition.

The distribution of companies with respect to the markets in which they are active is presented in Figure 3 (left). We can note entertainment, education/training and medicine as currently most active markets in terms of number of companies engaging in them (we have no means to evaluate the actual volume of these markets in terms of revenue). The geographical distribution of companies is presented in Figure 3 (right). The largest number of companies in a single country is found in the United States. However, nearly half number of companies can be found in North America and Europe.

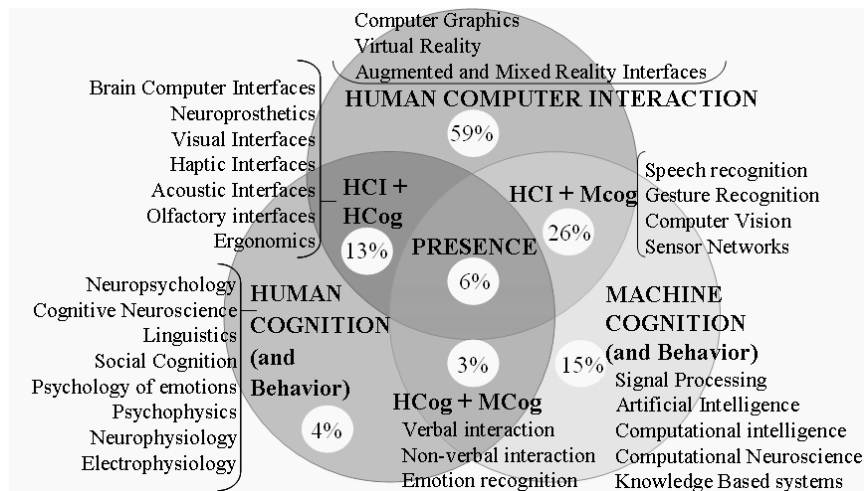


Figure 2. Distribution of Presence-related companies within the three pillars of Presence: numbers in white circles show the percentage of companies in each area

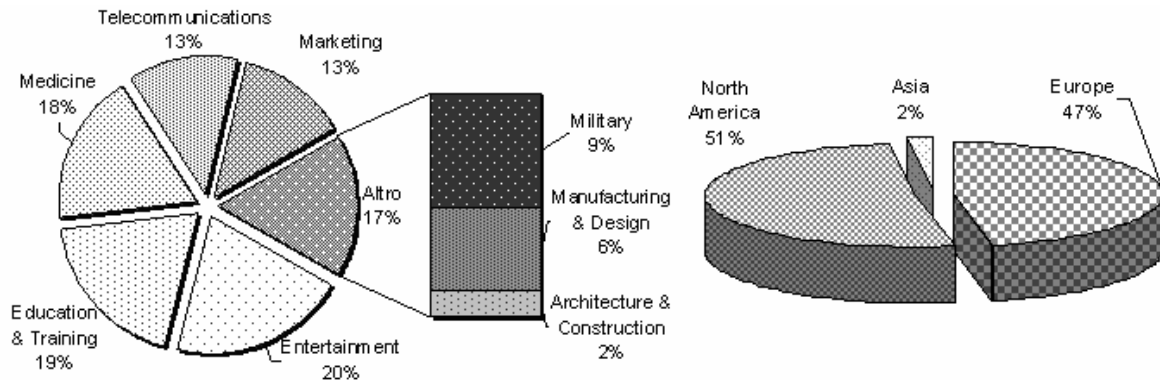


Figure 3. Distribution of Presence-related companies by market (left) and by geographic areas (right)

6. CONCLUSION

We performed an active analysis of the industry, searching for companies which have currently adopted or are producing solutions exploiting Presence technologies or applications. We identified so far 145 companies, which can be classified as active in eight markets or application areas. As part of this research we conducted two panel activities to explore the future applications for Presence in the identified markets, leaving experts free to add proposals also in unidentified areas. Results were mainly confirming the current applications, while some disruptive proposals are addressing experiences that do not have a counterpart in real life. The most populated market today is medicine, followed by entertainment and education & training. Most of the companies show a competence in human computer interaction technologies, like computer graphics, virtual reality, augmented and mixed reality. Aside from virtual reality, which is the most produced and used “technology” in the Presence markets, many companies are playing a role on computer graphics, that of course is central in 3D visualization and immersive environment rendering. Similarly, medical imagery is also a very well spread technology that will benefit from advanced visualization techniques. Our database of companies identified only a few companies with a competence on human cognition, suggesting perhaps that this is field is today more an academic or laboratory one. We also found out that the Industry is roughly geographically divided between North America and Europe. In the short term we conclude that the most relevant use of Presence technologies is in simulating activities to train and teach people to perform tasks more safely, inexpensively and faster or learn complex concepts; the second most relevant use is shared

stereoscopic visualization of objects. In the long term we envision a larger use of Presence technologies based on Neuroscience and emotion recognition and interaction; new interfaces capable of directly infer brain signals will be adopted to control machines or to recognize human intentions or mental states. This evolution will lower the borders between humans and machines, creating a mix of reality and virtuality, and letting people directly manipulate reality through machine mediated applications. Finally, we intend to keep working on this activity and these results will be updated in the near future.

ACKNOWLEDGEMENT

This work was supported by Peach, Presence Research in Action, FP6 Coordination Action No 33909. See <http://peachbit.org> for more information.

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HYBRIDPASS: AUTHENTICATION MECHANISM FOR WEB APPLICATIONS – BOTH SECURE AND USER-FRIENDLY

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ABSTRACT

A variety of visual passwords approaches were proposed that aim to replace conventional text passwords. The main advantage of both systems is that unlike biometrics and tokens they do not require special hardware. However they still fail to provide a satisfying solution to the usability problems of today's authentication systems. Both text and visual passwords have limitations. We show how those limitations can be minimized by combining the two systems together to provide an integrated login mechanism suitable for web applications. The design is user friendly and makes use of the human factor to enhance security and usability. Due to the hybrid nature of our approach, it includes an anti-phishing technique.

KEYWORDS

Secure login, authentication, visual password, user-friendly, usable security.

1. INTRODUCTION

Online systems traditionally depend on text passwords to authenticate end-users. However, they are not the only way to electronically verifying that people are who they say they are. Various methods have been suggested and developed based on different factors such as biometrics and tokens.

Text passwords consist of letters (a-z, A-Z), numeric values (0-9) and symbols (?, !, & etc) and can provide a reasonable level of security if used properly. However there are also many drawbacks and limitations [20] [5] [21].

Nevertheless, due to their usability as they do not require additional hardware (unlike biometrics and tokens) they are used on the vast majority of systems for authentication purposes [13].

Visual password approaches like Déjà Vu [12], PassPoints [27] and Draw-A-Secret [19] tried to replace text passwords completely, but at the cost of new threats and drawbacks. A problem common to most of them are shoulder surfing attacks; the user must ensure that no one else is watching the screen while they are in the process of signing into a system. Otherwise there will be a fair chance for people or cameras to recall their clicks and to gain unauthorised access.

Another limitation of visual passwords is the comparatively large amount of time it takes to register and sign-in [25]. This is in particular an issue with recognition-based approaches such as Déjà Vu and PassFaces.

On the other hand both text and visual passwords have their own unique advantages and this paper proposes a secure scheme combining both ideas together to strengthen the authentication process, illuminate their drawbacks and enhance usability as it plays a key role in gaining the trust of the end users [11].

2. BACKGROUND

Authentication mechanisms are used to provide the assurance of the identity of one entity to another. This process of confirming the identity of the originator can be achieved based on one or more of the following authentication factors:

- Something the user knows such as a password or any memorable information.
- Something the user has such as an ID card, security token or a cell phone.
- Something the user is or does; this can either be a physiological characteristic such as fingerprints and iris scanning or behavioural characteristics such as voice verification and keystroke dynamics.

Authentication schemes are typically built on one of the three factors on this list. However there are examples where two factors are combined together in a so called two-factor authentication system [4].

Text passwords fall into the first category (something the user knows). No additional hardware is required which makes this solution cost effective and more usable. This feature, in addition to its simplicity, makes it still the preferred approach to control access to web applications. Still the use of text passwords is problematic [9], [20], [5], [21], [16] and we will highlight some issues in more detail in the next section.

2.1 Problems with Text Passwords

One of the core problems with text based passwords is memorability. Users often forget their passwords or, to avoid this, write them down. Passwords which are easy to remember are most likely to be easy to guess or predict by other people or can be cracked using a dictionary attack. [24] [21]. Cheswick and Bellovin pointed out how weak passwords are the most common cause for system break-ins [10].

In contrast, forcing people to select complicated passwords as well as changing the password frequently to enhance the security level usually results in writing them down, which is again a serious problem. It is also very common that a single password is going to be used on multiple systems. Therefore, cracking that password will result in breaking into many systems easily.

Text passwords are easy to be shared with other people. This opens a door to successful social engineering in particular if the users are not trained enough on security policies.

Rather surprisingly cost is an issue as well. While the use of textual passwords is virtually free, many companies encounter costly procedures in relation to password reset and related administrative issues. For example, studies have calculated that every call made to the IT help desks costs an organization approximately \$25 (£15) and it has been estimated that up to 80 per cent of the technical support calls made to IT help desks are in relation to forgotten passwords [2] [18].

A survey [17] on how easy systems based on textual passwords can be compromised showed that “in many cases, the respondents themselves were compromising password protection, with 15% admitting to writing them down and 29% willingly sharing them with colleagues. In addition to this, 31 (21%) of the 151 respondents who used computers at work claimed to have used another person’s password without their consent or knowledge.”

2.2 Visual Password

Visual password schemes appear to be an obvious alternative to text passwords. Similar as to text based passwords they are not dependent on specific hardware. It has been shown that memorability of image passwords is better than text-based ones [9] [26]. Also visual passwords cannot be written down (but might be described). Describing visual passwords varies from scheme to scheme and image to image, but it is typically harder than sharing or writing down text passwords.

Visual password implementations and ideas are recognition based, cued recall or pure recall based solutions.

Recognition based schemes depend on user’s ability to remember what they have seen before such as Déjà Vu [12] which uses Random Art [6] images where the user needs to recall and identify them correctly in order to sign in. Random Art images are abstract pictures generated by computer software randomly.

Another example is Passfaces [3] which uses human faces instead of Random Art. The developers argue that the brain deals with faces in a special way, different than any other picture or object. People have the innate ability to recognize faces. So they are easy to be recognised [23].

Another category is cued recall systems. These schemes use images to give the users proper hints as a reminder for their passwords such as in PassClicks [14] and PassPoints [27] where users need to make a sequence of clicks on a particular picture whilst the system captures the mouse coordinates (x and y) on that image. An older idea to that was to predefine special areas (hot spots) on the image and the users click on some of them randomly to build their sign in credentials.[8]

Draw-A-Secret [19] is an example of the last category i.e. pure recall-based systems where the users have to draw something and memorize it for future login attempts. This idea is similar to signing papers in real life to prove the identity of the originator, whilst this scheme works by drawing some simple lines on a grid.

3. HYBRIDPASS

In the following we first discuss the design and implementation of our proposed system. Then we evaluate how this system performs in view of security and usability.

3.1 Description of the System

We developed a prototype that aims to combine the best of both worlds: For the users to successfully sign in, they need to enter a username and two types of passwords: a text password and a visual password.

Unlike traditional text-based passwords schemes, our text password needn't be long or complicated (i.e. consist of digits, letters and symbols). In fact any short memorable string will be appropriate without affecting the security of the login system. As the text password is only an initial part of the final password the system will not be prone to dictionary attacks.

A typical attack consists of presenting the user with a fake login screen, say via a link from a phishing email. The hybrid nature of our design makes it possible to provide an anti phishing technique that force the sign in procedure to stop. The correct set of images required to enter the visual password in our scheme shows up only after a valid username and correct text password have been entered. A fake website cannot interact with the user correctly in that way and without the right set of images, the users will not be able to start entering their visual password. Stealing the text password alone by this phishing technique is not enough to sign in. In addition the user is likely to notice that attack and might want to change their password as a result.

The visual password is cued recall-based where the user input consists of a sequence of few clicks on an image displayed in a clickable area. The image dimensions are 230 x 100 pixels only and the users are provided with four images displayed as small buttons at the left of the clickable area. Users can control which image to display continuously by clicking on the small buttons while doing the sequence of clicks. The screenshot of the system in Figure 1 (before entering the text password) and Figure 3 (after entering the text password) illustrates the idea.

Figure 1. HybridPass sign in form

The system provides a virtually infinite repository of images and the users are meant to select their favourite four during the registration stage. These images can be changed by the users anytime after signing in.

The four images are usually hidden on the sign in page, until a valid username is entered with a correct text password. This way if a phishing site tries to capture the users' credentials, the users wouldn't be able to give away their visual password because the fake site wouldn't know which images to display to a particular

user in the first place as we explained earlier. Another advantage of this setup is that the user is not able to choose the same visual password on different systems. Every site adopting this scheme can maintain their own individual repository of images to create visual passwords.

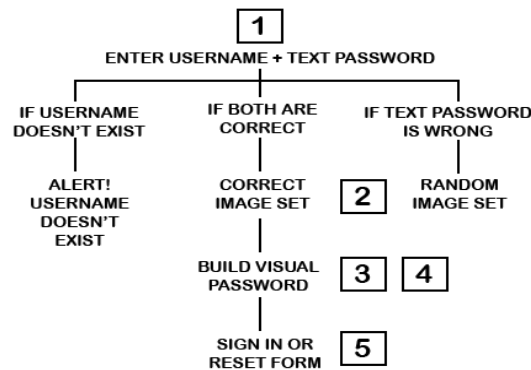


Figure 2. Schematic view of the sign in process

The screenshot shows a web form for signing in. It includes a 'User name' field (labeled '1') with the value 'my_username', a 'Password' field with masked characters, and a 'Visual password' field (labeled '4') showing a sequence of four images (labeled '2'). A counter indicates 'You have made 0 clicks so far.' Below the images are 'Click here to sign in' and 'Reset' buttons (labeled '5'). A third label '3' points to the area where a selected image is displayed at a larger size. The footer shows '©2008 HybridPass'.

Figure 3. Sign in form after entering a valid ID and any text password.

After recognizing the four images ('2' in Figure 3) the user knows that they can trust the website. Then they can enter their visual password by clicking the required sequence in the images. Our system includes here a recognition-based technique to enhance security.

The numbers in Figure 3 stand for the following:

1. Two fields to enter a user name and text password.
2. Four preselected images by the user to create the visual password.
3. The clickable area: clicking on any image from (2) displays it here with a bigger size, thus, the user can click inside the image to create the visual password.
4. Visual password field. This also gives information of the number of clicks made so far.
5. Sign in and reset buttons

The sign-in process is illustrated in Figure 2. Each and every click will add three strings to the visual password field ('4' in Figure 3). First and second values will be the coordinates (x and y) of the mouse position on the image (e.g. "35;70", "40;64" etc). The third string is a special identifier to represent the image the user clicked on (e.g. "x!", "hd", "?&" etc). Therefore a password of three clicks on different images could look something similar to this:

35;70;x!;40;64;hd;110;29;?&;

Apparently the semicolon is being used as a separator between the different strings in our system.

Hashing and storing the password in the database is an issue, because users will not be able to click exactly on the correct spot, for that our scheme has some tolerance distance of 4 pixels from the actually click point. Having tolerance distance means not having the exact same value every time the user sign in, thus, the hash comparison will fail even if the user clicks within the tolerance distant.

This problem can be solved by using Birget et al.'s algorithm using three discretization grids [7].

The previous paragraphs showed the authentication process. For the registration process the user selects a user ID and four unique images and after that a number of positions on those four images. This allows them to create their text and visual passwords.

3.2 Usability of the System

The ISO defines usability as the “effectiveness, efficiency and satisfaction with which a specified set of users can achieve a specified set of tasks in a particular environment”. These aspects are ultimately concerned with memorability, learnability, error frequency, productivity and satisfaction. Our scheme requires two types of passwords instead of one, which might not be considered as a more user friendly solution compared to the normal text-based password approach. However after adopting good security practices text-based password are actually more complicated.

For instance, Lloyds [1] secure sign in procedure for internet banking consist of a nine digits username, a text password that should be 6 characters in length, yet it is advisable to make it 8 [15] and in addition a memorable information which must be a mixture of letters and numbers between 6 and 15 characters long. Similar requirements on the choice of the secrets can be identified in other (security critical) applications.

With HybridPass, users can authenticate themselves on a single page rather than multiple pages. Registration and sign in process in visual-based solutions are typically known to be slow [25] specially with recognition-based approaches. In contrast the HybridPass prototype proves that a system can be coded and presented on a single page. Using acceptable image sizes makes the interaction with users easier.

The size of the clickable area is limited, but in practice, there are no problems with finding clickable points if the used images are suitably chosen. We noticed that normal pictures are indeed harder to use, but an initial prototype test worked very well with cartoon images.

Ajax (asynchronous JavaScript and XML) is used to submit data to the server without reloading the page, so when the text password is entered and a set of visual passwords appear no page will be reloaded. The whole setup of the system with this technology guarantees a smooth user experience.

From above, our arguments regarding usability are based on theoretical comparisons to propose a good possible solution based on current technology. A prototype has been coded and it is expected that further experiments with end users will confirm the theoretical work.

3.3 Security

To measure security we discuss six typical criteria known to be problems in authentication systems such as social engineering [22], spyware, key loggers and cracking tools. [10] [24] [17].

3.3.1 Password Space

There are 94 standard ASCII keyboard characters, hence in a traditional text based password system, given the advised length of eight characters there is a password space of $948 \approx 6 \times 10^{15}$ words.

Our hybrid password is a combination of visual and text passwords where the password space calculates as follows. We should however note that because the number of images to choose from is virtually unlimited we may argue that the password space is a priori infinite. However for a sensible comparison we calculate assuming that the four chosen images are fixed. We will see that even then we obtain a larger space.

Visual password space:

The dimensions of our clickable area are 230x100 pixels. If we assume a tolerance space 4 pixels away from the actual click point we have a grid square size of 9 x 9 pixels. That is $(230 \times 100) / (9 \times 9) \approx 284$ grid squares. The clickable area displays four images continuously (controlled by the user) at the time of signing in, then, the users have $284 \times 4 = 1136$ grid squares to click. The password space for four clicks will be: $11364 \approx 1.6 \times 10^{12}$. Five clicks will give $11365 \approx 1.8 \times 10^{15}$.

If the image was poorly selected and half of its space has no memorable features, we still have a password space of $5684 \approx 10^{11}$ (four clicks) or $5685 \approx 5.9 \times 10^{13}$ (five clicks).

Text password space:

Four letters length text password will be having a password space of $944 \approx 7.8 \times 10^7$. Hence the combination of both the text based password space and the virtual password space in HybridPass gives even

with the most conservative estimate in total a magnitude of $7.8 \times 10^7 \times 10^{11} = 7.8 \times 10^{18} > 6 \times 10^{15}$, i.e. well greater the password space based on an eight character 'traditional' password.

3.3.2 Shoulder Surfing

Observing someone while entering a visual password has always been a problem especially that the technique is displayed on the monitor. The keyboard could also be watched while typing in the text password. Our scheme uses both, so for shoulder surfing to succeed, the attacker needs to watch both the monitor and the keyboard. In addition HybridPass does not leave click marks on the screen to make this kind of attacks more difficult. Also the clickable area size is not big.

3.3.3 Spyware and Key Loggers

Computers that have been compromised with a keystroke logging system result in stealing passwords typed in by the attached keyboard. HybridPass makes this kind of software useless unless they capture mouse motion and clicks as well as keystrokes used at that same time.

3.3.4 Social Engineering

While text passwords can be written down and/or given away easily, by pronouncing the letters, numbers and symbols, visual passwords require more time to be communicated. Given the complexity of the images used, revealing passwords over the phone or by writing them down will be far less straightforward. With the additional standard safeguards that accounts will be locked after a certain amount of failed signing in trials this system will make social engineering more demanding for a prospective intruder.

3.3.5 Guessing

When entering a valid username and the correct text password, the system will display the correct set of images to start building the visual password. If a wrong text password is entered along with a correct username, the system will display a random set of images and save the result in a log table. This helps to protect the text password, so that if an attacker tries to enter that same password again, the system can simply display the same set again as well. This way our scheme does not reveal to the unauthorised user whether a text password has been entered correctly or not. Only the real user can notice if the right or wrong set of images has been displayed.

The image repository where the user chooses their pass images from is provided by the service provider. Hence the visual password does not primarily depend on something related to the user's personal details. Chances for people to guess someone's password this way are more difficult.

3.3.6 Brute Force

Brute force attack happens either online, which can be stopped by locking the account after reasonable number of sign in attempts and offline attack against the hashed password after reaching the database file. The larger password spaces as discussed in Section 3.3.1 makes such an attack less likely to succeed than with text based passwords.

3.3.7 Dictionary Attack

If text passwords are to fail sometimes in front of dictionary attacks, then visual passwords are much more reliable and secure. Because the number of images the users can select is essentially unlimited HybridPass will prevent this attack and remain strong even in front of tools and algorithms which try to analyze images and build dictionaries of the most selectable points.

4. CONCLUSION AND FUTURE WORK

Combining visual techniques with text based ones to increase users' memorability for passwords can be very promising as we increase the password space dramatically and reduce the password length at the same time. We implemented such a system with HybridPass. Our scheme proved that the hybrid nature of the system can be used effectively to make the system more secure against a variety attacks such as phishing, dictionary

attacks and social engineering while at the same time maintaining usability. Hence the HybridPass is indeed more user friendly and secure than as conventional system.

Future work will focus on a large scale deployment of the system to allow running extensive tests in particular to identify the best suitable images for that type of system.

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VIDEOGAME PLAYING, CELL PHONE USE AND ACADEMIC PERFORMANCE: SOME GOOD NEWS

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ABSTRACT

In this research we examined the effects of children's videogame playing and cell phone use on their academic performance. Gender, race, and income were also considered. Academic performance was measured in terms of grade point averages (GPAs) and scores on standardized tests of reading, mathematics and visual-spatial skills. Participants were 482 children, average age 12 years old; one third were African American and the remaining were Caucasian American. All measures were completed twice, with a one-year interval between them. Results indicated that greater videogame playing was associated with better visual-spatial skills but lower scores on standardized tests of mathematics skills and lower GPAs. Cell phone use had no effects on academic performance. Gender, race and income played a role in videogame playing, cell phone use and academic performance. Implications for the potential long-term benefits of videogame playing and future research on children's cell phone use are discussed.

KEYWORDS

Videogames, Cell Phones, Academic Performance

1. INTRODUCTION

A large majority of adolescents in the U.S. (81%; Pew, 2006) and elsewhere (Jackson, 2008) play videogames online. Early reviews of the relationship between videogame playing and cognitive skills suggested a positive relationship between videogame playing and one particular type of cognitive skill - visual-spatial skills, (Subrahmanyam, Kraut, Greenfield, & Gross, 2000; Subrahmanyam, Greenfield, Kraut, & Gross, 2001). Visual-spatial skills are considered by many to provide the "training wheels" for performance in science, technology, engineering and mathematics and so their development is highly valued (Subrahmanyam et al. 2001). More recent studies suggest a causal link between videogame playing and visual-spatial skills, at least among adults (Green & Bavelier, 2007). Adults who play videogames more subsequently perform better on tasks requiring strong visual-spatial skills than adults who play less.

On the other hand, a large number of studies have found a negative relationship between children's videogame playing and their academic performance (Walsh, Gentile, Walsh & Bennett, 2006). Children who play videogames more have lower grade point averages and more problematic behavior in school, as reported by teachers, than do children who play less. Moreover, playing violent videogames has been linked to aggressive cognition and behavior, both immediately after playing and for years to come (Anderson, Gentile & Buckley, 2007).

Willoughby (2008) recently reported the results of a longitudinal examination of the effects of both videogame playing and Internet use on adolescent boys and girls in 9th and 10th grades, and again in 11th and 12th grades. She found that most girls (93.7%) and boys (94.7%) used the Internet at both time periods, but far more boys (80.3%) than girls (28.8%) played videogames online in both time periods. Linear and curvilinear relations were found between parental relationships, friendship quality, academic orientation, and well-being measured in early high school and the frequency of technology use in late high school. Of greatest importance to the present study are findings that moderate use of the Internet was associated with a more positive academic orientation than nonuse or high levels of use, whereas greater videogame playing was associated with a weaker academic orientation. In the present research we hypothesized a positive relationship between videogame playing and visual-spatial skills and a negative relationship between

videogame playing and academic performance, as measured by GPA and standardized tests of reading and mathematics skills.

As of 2007, the global cell phone market contained approximately 1.8 billion subscribers. It is forecasted to reach 3 billion by the end of 2010, at which time nearly half of all human beings on earth will have and use a cell phone (Merry, Domlija, Mackenzie et al., 2005). Although voice calls currently account for about 80% of cell phone revenue, the short message service (SMS), or text messaging, is becoming extremely popular, particularly among younger cell phone users. In fact SMS is expected to dominate mobile messaging in both traffic volume and revenue by the end of this decade (Crabtree, Nathan, & Roberts, 2003). SMS is a favored mode of communication among youth who have access to cell phones (Jackson, 2008).

Little is known about the extent and consequences of cell phone use by children (Ling, 2004; Prichard, 2004). Indeed only a handful of researchers have begun to explore the social impact of cell phone use among adults (Haste, 2005). One study examined individual differences in preferences for cell phone voice communication over SMS (Reid & Reid, 2007). It found that personality characteristics predicted preferences, with shy, introverted adults preferring SMS and outgoing, extraverted adults preferring voice communication. Although there is no evidence that using a cell phone is in any way harmful to children there is nevertheless a widespread concern that cell phones may be harmful for at least two reasons. First, cell phones can be used by youth to engage in “devious” behavior, such as sending answers to test questions during an exam. Second, cell phones can be used to engage in behaviors that directly harm others, such as bullying or spreading malicious rumors about others. Nevertheless, as a technology whose purpose is to send and receive information, cell phones have the potential to facilitate or detract from academic performance. No specific hypothesis was formulated about the relationship between cell phone use and academic performance because this relationship has never been empirically examined.

Also included in our research were three socio-demographic characteristics known to be related to both academic performance and IT use. They are gender, race and income. First, there is overwhelming evidence that males play videogames more than do females (Gentile et al., 2006; Jackson, 2008; Subrahmanyam et al., 2000; Subrahmanyam, et al., 2001). There is also considerable evidence that females perform better in school than do males, especially when classroom performance is considered (e.g., GPAs, course grades) rather than standardized tests of achievement (e.g., reading, mathematics; Hyde, Lindberg, Linn, Ellis, & Williams, 2008; National Center for Educational Statistics, 2007). Second, in general, Caucasian American children perform better in school than do African American children, regardless of whether performance is measured in terms of classroom performance or standardized tests of achievement (Jackson, et. al., 2006; Fisher, 2005; Russell, Rumberger & Palardy, 2005; Todd & Wolpin, 2007). Third, higher family income has been repeatedly associated with better academic performance and greater IT use (Jackson, 2008; Pew, 2006, 2007). Thus, all three factors were considered in our effort to understand the relationship between videogame playing, cell phone use and academic performance.

2. METHODS

2.1 Participants and Procedures

The sample consisted of 482 children, 227 males (47.1%) and 255 females (52.9%). About one-third was African American (32.7%) and about two-thirds were Caucasian American (67.3%). Average age was 12.19 years old (standard deviation (*sd*) = 0.72), and median grade level was 7th grade (69.2%). Grade level ranged from 6th to 11th grade (1 student). Race differences in age indicated that African American children were somewhat older (12.29 years old) than Caucasian American children (12.14; $F(1, 486) = 4.91, p < .05$).

Most participants ($n = 400$) were recruited from 20 middle schools geographically distributed throughout the southern lower peninsula of Michigan. The additional participants, all of whom were African-American, were recruited from an after-school center in Detroit, Michigan. Comparisons between them and African-Americans recruited from middle schools revealed no differences in socio-demographic characteristics.

Parent/Guardian Surveys and Child Surveys were mailed to homes and returned in a self-addressed, postage paid envelope. A cover letter described the research as a 3-year longitudinal study of the impact of information technology use on children’s development. Participants were compensated \$25 each time they

returned a completed Parent/Guardian Survey and Child Survey, and each of these times were entered into a lottery for a grand prize drawing of \$500 as an additional incentive for participation.

2.2 Measures

Children were asked how often they used the Internet, how often they played videogames, and how often they used a cell phone using the following scale for each measure: 1 = I do not use (play) at all, 2 = about once a month, 3 = a few times a month, 4 = a few times a week, 5 = everyday, for less than 1 hour, 6 = everyday, for 1 to 3 hours, 7 = everyday, for more than 3 hours.

In the first section of the Child Survey participants provided socio-demographic information (e.g., race, gender, age) and information about academic performance. Specifically, children were asked "What grades do you usually get in school?" 1 = Mostly As, 2 = Mostly Bs, 3 = Mostly Cs, 4 = Mostly Ds, 5 = Mostly failing grades. This measure was reverse scored so that higher values indicated better grades. Next they were asked to indicate their grade point average (GPA; 1- 4 scale where higher values indicate higher GPAs). The rationale for including both measures was that children in this age group do not always know what a grade point average is, much less know their own grade point average. The lower response rate to the GPA question, evident in the results discussed later, supports this rationale. As expected, the two measures were highly correlated.

Household income was assessed on the Parents/Guardians Survey. Parents/Guardians were asked to indicate their total net annual household income on the following scale: 1 = Under \$20,000, 2 = \$20,000 to \$49,999, 3 = \$50,000 to \$79,999, 4 = \$80,000 to \$99,999, 5 = \$100,000 to \$149,999, 6 = \$150,000 to \$200,000, 7 = over \$200,000. Chi-square analyses were used to examine child gender and race differences in net annual household income. Both effects were significant (gender, $\chi^2(6) = 17.07$, $p < .01$; race, $\chi^2(6) = 41.93$, $p < .001$). The gender effect indicated that parents of males were more likely to be in the lowest income level (32.9%) than were parents of females (21.2%). The race effect indicated that more African American parents (43.1%) were more likely to be in the lowest income level than were Caucasian American parents (18.7%). Only 5.2% of African Americans were in the three highest income levels compared to 13.9% of Caucasian Americans. There were no gender or race differences in parent educational level.

Reading and mathematics abilities were assessed using the Wide Range Achievement Test, Revision 3 (WRAT-3; 1993). Visual-spatial abilities were assessed using the Wide Range Assessment of Visual Motor Abilities Section 2, Matching. The WRAT has been used for over 60 years and its reliability and validity are well established using diverse samples of thousands of participants. The three WRAT tests were administered face-to-face in small groups (1 to 5 children) at the children's middle schools, usually in the media center. Trained undergraduates administered the tests and hand-scored them immediately upon completion. Order of test type was randomized such that approximately one-third of the children completed the reading test first, one-third completed the mathematics test first, and one-third completed the visual-spatial test first. Order had no effect on the results and will not be discussed further. For all three tests higher scores indicated greater skills.

3. RESULTS

Descriptive statistics for the five academic performance measures, income, and two IT use measures for Years 1 and 2 are presented in Table 1. Attrition between years was 33% and unrelated to socio-demographic, IT use or academic performance measures. In both years standardized test scores were lower in mathematics than in visual-spatial or reading skills. Grades in school averaged around "mostly Bs" and average GPAs for participants who provided this information were also around B. Videogame playing was a far more frequent IT use than cell phone use in this sample of 12 year-olds.

Table 1. Descriptive statistics for academic performance, income and IT use

	Mean	SD	N
Visual-Spatial Test – Year 1 (VST-1)	29.92	5.63	351
Visual-Spatial Test – Year 2 (VST-2)	31.00	5.18	292
Reading Test – Year 1 (RT-1)	28.13	5.44	351
Reading Test – Year 2 (RT-2)	29.60	4.96	291
Mathematics Test – Year 1 (MT-1)	21.46	5.84	351
Mathematics Test – Year 2 (MT-2)	22.30	5.33	293
Grades in School – Year 1 (GIS-1)	4.14	1.69	478
Grades in School – Year 2 (GIS-2)	4.42	0.92	293
Grade Point Average -Year 1 (GPA-1)	3.29	0.67	315
Grade Point Average - Year 2 (GPA-2)	3.16	0.09	202
Income-Year 1 (INCOME-1)	2.57	1.70	468
Income-Year 2 (INCOME-2)	2.56	1.37	270
Cell phone use- Year 1 (CELL-1)	2.94	1.88	480
Cell phone use-Year 2 (CELL-2)	3.24	1.70	302
Videogame playing –Year 1 (VIDEO-1)	3.85	1.75	479
Videogame playing- Year 2 (VIDEO-2)	4.53	1.34	302

Note. IT = Information Technology. SD is standard deviation. N is sample size. For all academic performance measures higher values indicate better performance. Income (parent provided) is net annual household income: 1 = Under \$20,000, 2 = \$20,000 to \$49,999, 3 = \$50,000 to \$79,999, 4 = \$80,000 to \$99,999, 5 = \$100,000 to \$149,999, 6 = \$150,000 to \$200,000, 7 = over \$200,000. Cell phone use and videogame playing were measured on 1 to 4 scales where 1 = I don't use/play, 2 = about once a month, 3 = a few times a month, 4 = a few times a week, 5 = every day, but for less than 1 hour, 6 = every day, for 1 to 3 hours, 7 = every day, for more than 3 hours.

Correlations among measures of academic performance, income and IT use are presented in Table 2. Because gender and race are considered in the next analyses, correlations involving them will be considered later. Numbers below the diagonal are for Year 1. Those above the diagonal are for Year 2.

Table 2. Correlations among socio-demographic characteristics, academic performance and IT use

	1	2	3	4	5	6	7	8	9	10
1-GENDER	1	.05	-.21*	.17*	.11	.29*	.22*	.14*	.10	-.33*
2-RACE	.01	1	.28*	.19*	.46*	.39*	.47*	.33*	.04	.14 [†]
3-VT	-.18*	.09	1	-.04	.25*	.08	-.02	.16*	-.09	.70*
4-RT	.16*	.09	.19*	1	.16*	.22*	.29*	.16*	.18*	-.07
5-MT	.05	.27*	.11 [†]	.26*	1	.30	.27*	.39	.03	.11
6-GIS	.09 [†]	.14*	.03	.28*	.49*	1	.39*	.33*	-.02	-.24*
7-GPA	.19*	.32*	.05	.23*	.45*	.28*	1	.25*	-.00	-.21*
8-INCOME	.04	.18*	.10	.17*	.30*	.18*	.42*	1	.12	.12
9-CELL	.20*	-.18*	-.08	.03	.03	-.06	-.04	.04	1	-.11
10-VIDEO	-.53*	.01	.30*	-.00	-.08	-.09	-.16*	.12	.08	1

Note. [†] $p < .05$, * $p < .01$. Numbers below the diagonal are for Year 1. Numbers above the diagonal are for Year 2.

As predicted, there was a strong positive relationship between videogame playing and visual-spatial skills and a strong negative relationship between videogame playing and GPAs, but not with self-reported grades in school. This pattern was found at both Time 1 and Time 2 (i.e., a year later). Interestingly, there was no relationship between videogame playing and mathematics skills or between mathematics skills and visual-spatial skills, suggesting that these two skill sets are distinct, at least for children in this age group. It may be that as children advance to more sophisticated mathematical problems – problems that benefit from strong visual-spatial skills, the two skills sets become more highly integrated and integral to success in science, technology, engineering and mathematics.

Gender by race multivariate analyses of variance (MANOVAs) were performed on the 2 IT use measures and 5 academic performance measures separately, first of Time 1 and then for Time 2. On the 2 IT use measures at Time 1 the multivariate main effect of gender was significant, $F(2,474) = 90.91, p < .001$, as was the main effect of race, $F(2,474) = 7.65, p < .001$, and their interaction, $F(2,474) = 3.19, p < .04$. On the five academic performance measures the gender, $F(5, 207) = 3.40, p < .01$, and race main effects were significant, $F(5,207) = 11.25, p < .001$, but their interaction was not, $F(5, 207) = 1.11, p < .358$. Females used cell phone more frequently than did males and males played videogames far more frequently than did females, regardless of race. A significant univariate interaction indicated that African American females used cell phones the most and Caucasian American males used them the least.

Race differences in academic performance were consistent with previous research. Caucasian American children had higher grades in school and higher GPAs than did African American children. They also scored higher on standardized tests of reading and mathematics skills, but not higher on tests of visual-spatial skills than did African American children.

Hierarchical regression analyses were used to predict each of the five academic performance measures from the two measures of IT use for that year, after controlling for gender, race and income effects on academic performance. In Year 1, videogame playing predicted visual-spatial skills, $\beta = .28, p < .001$, reading skills, $\beta = .14, p < .05$, marginally and negatively predicted GPAs, $\beta = -.11, p < .08$, but did not predict mathematics skills or grades in school. Another significant predictor of academic performance during Year 1, consistent with previous research, was income. Income predicted children's reading skills, $\beta = .16, p < .01$, mathematics skills, $\beta = .24, p < .001$, grades in school, $\beta = .14, p < .05$, and GPAs, $\beta = .30, p < .001$.

Hierarchical regression analyses for Year 2 measures produced some interesting differences from Year 1. Videogame playing was again a strong and sole predictor of visual-spatial skills, $\beta = .63, p < .001$. However, it no longer predicted mathematics skills. Videogame playing was a negative predictor of grades in school, $\beta = -.26, p < .001$, and GPAs, $\beta = -.18, p < .05$. Income was again a predictor of mathematics skills, $\beta = .24, p < .001$, and grades in school, $\beta = .21, p < .001$. Unlike Year 1, cell phone use was a positive predictor of reading skills in Year 2, $\beta = .21, p < .01$.

To examine changes in academic performance over time as a function of IT use and socio-demographic characteristics we used latent variable autoregressive modeling techniques. Two models suggested by the data were tested:

Model 1: Mathematics skills and videogame playing

This first model comes with a normal theory-weighted least squares χ^2 estimate of 44.59 ($df = 22; p = 0.003$), a confidence interval for the RMSEA of 0.03 - 0.07, a CFI = 0.95, and a GFI = 0.98. We conclude that, with the exception of the χ^2 estimate (which is typically inflated), all goodness-of-fit indices support the model which is therefore retained. Figure 1 depicts the model. All paths represented are significant.

The model suggests the following relationships: (1) Race is unrelated to mathematics skills or to videogame playing at both points in time. (2) Income predicts mathematics skills in Year 1. (3) Gender predicts mathematics skills in Year 1. Females have higher mathematics skills than do males. (4) Mathematics skills predict themselves over time. (5) Videogame playing predicts itself over time. (6) Cross-time predictions of mathematics skills and videogame playing are equal in strength and both are retained in the model. (7) Videogame playing in Year 1 negatively predicts mathematics skills in Year 1.

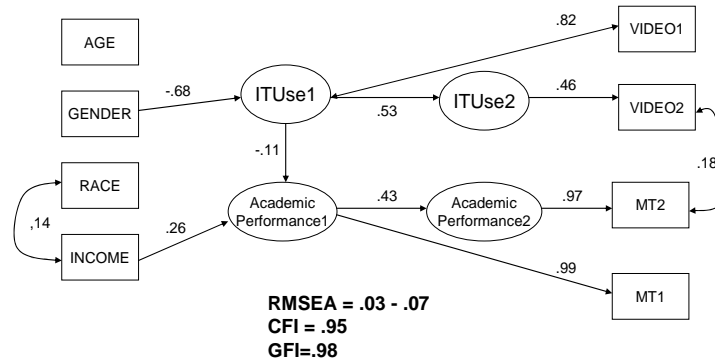


Figure 1. Videogame playing, mathematics test scores and academic performance

Note. IT = Information Technology. VIDEO = Frequency of videogame playing. MT = Mathematics Test scores. 1 is Year 1. 2 is Year 2. All values are significant standardized coefficients.

Model 2: Visual-spatial skills and videogame playing

The second model comes with a normal theory-weighted least squares χ^2 estimate of 66.95 ($df = 23$; $p < 0.01$), a confidence interval for the RMSEA of 0.05 - 0.08, a CFI = 0.93, and a GFI = 0.97. We conclude that again, with the exception of the χ^2 estimate, all goodness-of-fit indices support the model which is therefore retained. Figure 2 depicts the model. At first glance, the third model is identical to the second model. However, there is one important difference. Whereas videogame playing in Year 1 predicts lower mathematics skills in Year 1, it also predicts higher visual-spatial skills.

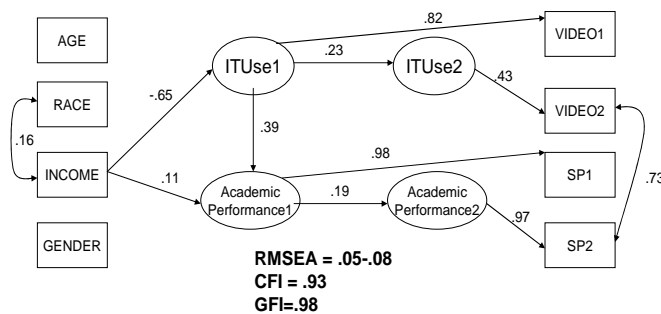


Figure 2. Videogame playing, visual-spatial skills and academic performance

Note. IT is Information Technology. VIDEO = Frequency of videogame playing. VST = Visual-Spatial Test scores. 1 is Year 1. 2 is Year 2. All values are significant standardized coefficients.

At first glance, the second model appears to be identical to the first model. However, there is one important difference. Whereas videogame playing in Year 1 predicts lower mathematics skills in Year 1, it also predicts higher visual-spatial skills.

4. CONCLUSION

This research addressed the question of whether or not IT use, specifically videogame playing and cell phone use, is related to academic performance. Findings indicate that videogame playing is most certainly related to academic performance but the nature of the relationship depends on complex relationships with other skills, namely visual-spatial and mathematics skills, as well as on socio-demographic characteristics of the child. For example, there was a strong positive relationship between videogame playing and visual-spatial skills and a strong negative relationship between videogame playing and GPAs at both Time 1 and Time 2. But there was no relationship between videogame playing and mathematics skills or between mathematics skills and visual-spatial skills, suggesting that these skill sets are distinct, at least in children in this age group. It may be that as children develop more sophisticated cognitive structures then visual-spatial and mathematics skills become more integrated. And it is this integration of skill sets that is essential to solving problems at higher levels of science, technology, engineering and mathematics. Thus, one immediate challenge for researchers and IT developers is to harness children's enthusiasm for videogames to the benefit of developing and integrating their mathematical and visual-spatial skills rather than to detracting from their current performance.

Cell phones proved relatively unimportant to academic performance in our sample of 12 year olds. Cell phones were use relatively infrequently in Year 1 (2.94 on a 7-point scale) although this frequency increased substantially by Year 2 (3.24). Cell phones have the potential to facilitate or detract from academic performance, depending on whether they are used in the interest of gaining knowledge about school work or used primarily as a social tool for connecting with others. Thus, one immediate challenge for researchers is to study cell phone use in an older population (e.g., college students) using fine-tuned measures that address what exactly is the user doing with the cell phone and why.

There is no question that the ever increasing ubiquitous presence of IT is changing the way we go about every day life. More research is needed to investigate the costs and benefits of these changes IT has been bringing about and, more importantly, how costs might be minimized and benefits maximized by changes in the nature of the technology itself or how it is used.

ACKNOWLEDGEMENT

We wish to thank the National Science Foundation for funding this research. We are also grateful to the 6 graduate students and 20 undergraduate students who assisted with this project.

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TAKING COMPUTER SCIENCE TO THE UNDERPRIVILEGED SECTORS OF SOCIETY

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ABSTRACT

From the beginning, the National University of La Plata (UNLP)[1] has had a strong commitment with the community, stressing and encouraging various extension activities. The Computer Science School [2] of the UNLP was created in the year 1999 and, ever since then, has participated in many activities to teach computer science to the least privileged sectors of our society. We worked with senior citizens, representatives of social NGOs, teachers and professors of different levels, Technological Community Centers representatives, etc. This year, the School began working on a project called "Reducing the digital divide in children and adolescents". This project, framed in the University Volunteering Program of the National Ministry of Education [3], has the goal of taking technology to children and adolescents of low economic resources which attend social diners, and to their families. This project is an undertaking of great social impact, as it constitutes yet another manifestation among those encouraged by the University and the Faculty with the goal of alleviating the digital divide existing between the who have access to technology and those who do not, by making ICTs (Information & Communication Technologies) approachable for everyone.

KEY WORDS

NGO, social diners, cybercafés, computer literacy, digital divide

1. INTRODUCTION

Although the use of computers has been increasing considerably, in our country there are sectors of the population in which this technology is still far. In the particular case of the City of La Plata [4] and the sector of Gran La Plata, which is one of the most important conglomerates of the Province of Buenos Aires, there are zones which are still under much poverty. According to data from the INDEC [5], in Gran La Plata, over an estimated number of 712 thousand inhabitants, 17.8% of the population is below the poverty line.

Social Diners are places where people go to alleviate their needs and where children not only have access to a basic alimentation, but also learn crafts, have school support and are reinserted in the educational system.

The Computer Science School of the UNLP is very committed with its environment, and, for many years, has been actively working with different sectors to reduce the digital divide existing in our society.

It has worked with senior citizens, training them in the use of the Internet [6], with teachers and professor of many different educational levels, training them in free software [7] and with adolescents belonging to social NGOs, training them in computer science, with the goal of preparing them to have access to a dignified job position [8]. In the CLAD [9] the Lic. Javier Díaz presented, among others, the computer literacy plans which have been taking place in many sectors of the community, including the project described in this article.

This year, we began working in the project "Reducing the digital divide in children and adolescents" [3], framed in the University Volunteering Program of the National Ministry of Education whose main goal is to take technology to children and adolescents of low resources which have access to social diners of the city. We worked specifically in three (3) social diners of the neighborhoods of Tolosa, Mercadito and Aeropuerto of the City of La Plata, where 77 children between the ages of 5 and 12 were trained. We provided many children with their first contact with a computer, as it is important to take into account that public schools in our city have very low resources and very few of them have a computing room and the possibility to include Computer Science in their curriculum.

The goal of this article is to describe the experience undergone in this project by analyzing the problems found before and during its development and emphasizing the evaluation stage implemented throughout the year. The evaluation process was systematic, continuous and integrating, and it permanently complemented and helped improve the teaching process. It took into consideration both quantitative and qualitative values and contextual information. We used information collecting techniques such as interviews, questionnaires, focus groups and direct observation, and the sources of information were the people in charge of the social diners, the teachers and the students themselves.

Although there are some similar initiatives across the country [10], in our region (La Plata and surroundings) it is the first project emerging from a Public University and proposing a continuing line of work. These projects must be based on continuity, transcending the different managements, thus gaining the trust of the people involved in a continuous education. The teachers will be able to plan on short, medium and long term and the students will have the certainty that their training will continue year after year.

2. INITIATIVE

In the year 2007, the Computer Science School, through its Secretary of Extension [11] presented a Project called "Reducing the digital divide in children and adolescents" in the call for the National University Volunteering Program of the Secretary of University Policies of the National Ministry of Education. The project was authorized at the end of that same year.

The goal of the project was to teach computer literacy to children and adolescents from different diners of the city and its surroundings. In the case of children of school age, the literacy was taught through the application of computer science to fully educational topics. In the case of adolescents, the literacy was oriented to a formation which would give them access to a dignified job position in the future.

This undertaking was very important and of great social impact, as most of the diners do not have Computer Science training, and most primary schools do not include Computer Science in their curriculum,

This initiative was another display of the interest of the University, and this particular Faculty, in establishing a transcendental bond with this community sector which is excluded from the information society.

3. PARTICIPANTS IN THE PROJECT

The group of people integrating the project was formed by teachers of the Computer Science School and students of many academic units, such as the Computer Science School, the Humanities School [12] and the Economic Sciences School [13].

All of them participated actively and voluntarily, doing field work, training the children and adolescents directly and working in the creation and proposal of different activities.

Although the teachers organized and set the guidelines for the topics to be seen in each class, they were open to modifications by the volunteering students, in relation with their own experiences with the students.

4. PROJECT DEVELOPMENT

As part of the project development we can speak of the selection process for the diners, the location for the training, the organization, the call for the groups and the training itself.

Regarding the selection of the diners and the training location, we selected three out of a list of potential diners to work with. The number stipulated was closely related to the amount of volunteers we had. The choice was made under the criteria that the selected diners had to be located in cardinal points of the city.

The diners selected were:

- "Las Tablitas", located in 6 bis between 613 and 614. Barrio Aeropuerto.
- "Los chicos del futuro" or "Comedor de Wimpy", located at 519 between 119 and 120. Barrio el Mercadito.

- “Los chicos primero”, located at 522 between 117 and 118. Barrio Tolosa.

Regarding the choice of the training location, because of its very nature, the room had to have computers. The ideal was that the diner itself had the resources necessary for the training, as this would allow the child to remain in a familiar environment, but this was not possible in most cases. This situation forced us to find another location for the training and, as an alternative, we thought of the cybercafés¹ near the diners.

The situation of each diner was analyzed individually, as the problems which arose were very different from one to another.

When working with the “Los chicos primero” diner, we used a cybercafé that belongs to it; to work with the “Wimpy” diner, we used a very precarious cybercafé that, although it had only four PCs which, at the beginning, did not have access to the Internet, was near the diner; and with the “Las Tablitas” diner, we worked with a cybercafé near the diner.

We coordinated the schedules for the training with the owners of the cybercafés, so they would only allow access to the project participants. With the exception of the cybercafé belonging to the “Los chicos primero” diner, we agreed on a price for the hours of use.

Regarding the organization and call for the groups, we had the participation of the referents of the location and, in the case of the Wimpy diner, of the teachers and students of another project from the Humanities School of the UNLP which has been taking place in the diner for many years.

It is worth stressing the commitment made by the referents of the diners, on which the project’s success depended largely. They are the ones who have real knowledge of the situation of the children which take the course and their families, and how to make the parents understand the importance of training their children.

This was observed in the project with the incorporation of the last diner: “Los chicos primero”. Its referent was not as committed as the others and this was reflected in the results. We had at first organized 2 groups of up to 10 children each, a number we never reached, having at some point only 5 students. Because of the insistence and perseverance of the teachers of this project, we could end classes with 15 students.

Regarding the training, we first surveyed the computer literacy existing in the group of students. Of a total of 77 children between the ages of 5 and 12, only 11 had had contact with a computer at least once. None of them was taught Computer Science at school and the children that had some kind of knowledge had acquired it at home from their personal computers or at the cybercafé.

The computer literacy was proponed in a progressive manner and with the intersperse execution of practical applications related to educational topics seen at school, generally related to mathematics and language. The goal of these practical applications was to achieve their discovery of a different tool to the ones normally used which would allow them to strengthen the knowledge acquired at school.

The classes were set up for two groups, one formed by children between the ages of 6 and 9 years old and the other by children between the ages of 10 and 12. The concepts imparted were the same, only the way to present them and the activities related varied.

Since the beginning of the training, we communicated the project volunteers the choice of the direction regarding the work methodology to be applied: they could not give a new topic until they had irrefutably proved that the last one had been understood by the students.

We used applications such as spreadsheets and text editors to carry out activities related with the theory learnt and many educational applications from educational web sites were used. We also created our own applications, using office programs such as spreadsheets, in which we programmed macros which enabled the students to generate new activities of the same type and the teachers to correct the activity indicating wrongs and rights. We also used Jclíc[14] for activities such as crosswords, jigsaws, matching games, etc.

We created local access web sites, with client-side programming, using Javascript[15] and Dom[16].

5. PROJECT EVALUATION

The project called “Reducing the digital divide in children and adolescents” is in an advanced development stage. We have currently ended the 2008 academic year and achieved the initial computing training in children and adolescents in a systematic and complete way. This gives place to a final reflection on the entire

¹In our social reality, the cybercafé is a service demanded by all the social strata. It provides the possibility of access to knowledge and entertainment at a low cost.

experience and the analysis of all the evaluations performed during the year which accompanied the teaching process.

All the information which was collected in the successive evaluations by means of techniques such as interviews, questionnaires, direct observation and focus groups was debated in meetings with the coordinators in order to improve the teaching process and establish a permanent articulation between the evaluation and the training processes.

The following sections explain the most important evaluations performed on the basis of 77 children, which show the obtained results. Below them is a general analysis of the evaluations.

5.1 Initial Evaluation: about the Student Profiles

Teaching basic computing was among the goals of the project, but these contents could not be correctly transmitted without a previous survey of the community the training is aimed at. In this special case, it was necessary to know the age of the children participating, their background, whether they could read and write, if they had had previous contact with a computer and other matters.

We organized questionnaires and surveys and the sources of information were the people in charge of the social diners, who already knew the children, some parents, and, if older than 12, the children themselves.

The following tables reflect the results obtained:

Table 1. Age of the children

Regarding the age of the children	
Under 7 years old	12
Between 8 and 11 years old	55
Over 12 years old	10

Regarding their previous knowledge, a more exhaustive study was performed than the one shown on the table, which specifies only the percentage of children in the least favorable situations:

Table 2. Previous knowledge

Regarding their previous knowledge	
With very little general literacy	15,6%
Without schooling	0%
Without contact with a PC	85,7%
With contact with a PC	14,3%
With computing background	0%

We also analyzed whether the students had problems which may complicate the teaching process or require the presence of auxiliary staff. Within cognitive problems we included the children with concentration problems, memorization problems or those under psychoactive medication.

Table 3. Problems with the children

Regarding problems with the children	
Related to behavior	3,9%
Related to motion	0%
Related to cognition	6,4%
Other problems	5,1%

5.2 Participation Evaluation

It is important in a project aimed at children that the training is constantly monitored and evaluated, taking into account their interest, attendance and participation.

These evaluations were performed by the teachers as of the third month of the project. These teachers had attendance charts and a registry to write information on the behavior and participation of the children in class.

Regarding their attendance, table 4 shows the amount of children with perfect attendance, the amount which was absent for lack of interest or other reasons:

Table 4. Attendance

Regarding their attendance	
Perfect attendance	80%
Illness-related absence	18%
Absence for lack of interest	2%
Other reasons for absence	0%

Regarding the participation of the children, it is worth stressing that it increased every day as the group was reinforced and consolidated. The percentages can be visualized in the following table:

Table 5. Participation

Regarding their participation	
Permanent participation	15%
Sporadic participation	80%
Little participation	5%

5.3 Academic Evaluation

The teachers registered systematically how the activities proposed in the classroom were perceived by the children, taking into account if they were accepted or not, if they were completed or not, or if the children received assistance. The students were permanently and individually monitored during class hours.

All this information collected with direct observation was debated in meetings with the coordinators to improve the teaching process and establish a permanent articulation between the evaluation and training.

Below we show the results of the evaluations of practical applications and the final project.

Table 6. Practical applications chart

# Task	Description of the task	Complexity of the task	The student worked		
			Alone	Assisted by a teacher	Assisted by a peer
1	Hardware Software Concept	low	90%	10%	
2	Hardware Software Revision	medium	100%		
3	CPU (identify model and maker of the CPUs in advertisements)	high	75%	25%	
4	CPU Revision (on paper, join words in the left column with words in the right)	medium	15%	80%	5%
5 to 7	CPU Revision (movement of models and makers)	medium	80%	20%	
8	RAM Memory (complete the drawing of a RAM and a CPU)	low	100%		
9	RAM Memory Revision (complete data about RAM memory)	high	15%	85%	
10	Revision on paper of Hardware and Software, CPU and RAM concepts (correct test)	medium	10%	80%	10%
11	Revision on paper of Hardware and Software, CPU and RAM concepts (crossword)	medium	70%	20%	10%
12	Auxiliary memory (draw the hard drive enclosure)	medium	100%		
13	Revision of Hardware and Software, CPU and RAM concepts (draw the enclosure with all the characters inside and indicate the function of each one)	high	100%		
14	Revision on paper of Hardware and Software, CPU and RAM concepts (use of Paint and Word)	high	5%	80%	15%
15 to 17	Revision of all topics (with use of Paint and Word)	high	15%	85%	
18	Software: definition of program and system	medium	35%	54%	11%
19	Definition of operating system	medium	23%	67%	10%

20	Window management (with screen captures)	high	11%	87%	2%
21	Opening files and saving information	high	9%	88%	13%
22 to 24	Revision of the creation of a cartoon, of program execution, opening files and saving information	very high		100%	

Regarding the final project, at the end of the course the children had to make a series of three cartoons which showed how the different computer components interacted with each other in a determined process, such as: the execution of a program, opening and saving a file.

Using panels from the finished cartoons, the students had to organize and complete them with the corresponding dialogs, so that the sequence would represent each of the proposed processes.

The youngest students completed at least one of the cartoons, while the oldest were generally able to complete the entire task.

All the students required, to a greater or lesser extent, help from their teachers, who also supervised that the work was done correctly.

The results of the final project are summarized in the following table:

Table 7. Evaluation on the final project

Evaluation on the final project	
Did only one cartoon	39%
Did two cartoons	35%
Completed the entire project	26%

5.4. Subjective Evaluation by the Students

As was mentioned at the beginning of this article, we considered both quantitative and qualitative valuations. Information such as the opinion of the children, whether the training had fulfilled their initial expectations, if they felt comfortable, if they were happy, was very significant data for the teaching staff and the coordinator, as important as the rest.

In this case, the teachers organized a questionnaire that the children had to complete using the computer. The results were as follows:

Table 8. Subjective evaluation by the students

Regarding the subjective evaluation by the students			
1. Were you interested in learning Computer Science?		2. If you had a PC, what would you use it for?	
Very much	100%	To study	75%
A little	0%	To investigate	12%
No	0%	To play	90%
Not applicable	0%	NA	0%
3. Did you enjoy all the topics you learnt?		4. Was there a topic you did not understand?	
Yes	85%	Yes	25%
Only some	15%	No	75%
No	0%	NA	0%
NA	0%		
5. Did you like the way the teachers taught you?		6. Did you like coming to classes?	
Very much	100%	Very much	100%
A little	0%	A little	0%
No	0%	No	0%
NA	0%	NA	0%
7. Would you like to learn more Computer Science next year?		8. What would you like to learn about Computer Science next year?	
Yes	100%	Internet	100%
No	0%	E-mail	35%
NA	0%	Graphic programs	40%
		Specific programs	12%
		Topics of this year more in depth	36%
		Others	0%

5.5. Internal Evaluation

At the end of the academic year we organized a focus group meeting, attended by eight teachers and a coordinator. During the meeting, we worked on four topics which gave place for debate and reflection.

The following table summarizes this evaluating activity:

Table 9. Internal evaluation

Internal evaluation of the teaching staff and coordinator			
Contents		Pedagogical aspects and teaching methods	
Were interesting	100%	Through games	85%
Some modifications are needed	35%	Through classes	1%
Were not useful	0%	Through practical applications	100%
Were not applicable	0%	Through exploration	100%
Other comments	0%	Others	0%
Resources		Experience before a socially impacting activity	
Sufficient	100%	Was fulfilling	100%
Insufficient	0%	Unfulfilling	0%
Obsolete	0%	Uninteresting	0%
NA	0%	NA	0%

6. ANALYSIS OF THE RESULTS OF THE EVALUATION PROCESS

According to the results obtained in the different evaluations performed during the project, we can conclude with the following analysis:

- There was a high level of satisfaction in seeing children who had never been in contact with a PC before copied, pasted, wrote and filled information on basic computing issues. (Tables 1, 2, 6 and 7)
- There was a noticeable change in the students who had had contact with a PC, which they associated exclusively with entertainment and understood its importance in education and research.
- The interest and participation of the children, reinforced during the course, was surprising. This was reflected in the fact that many of the students attended classes they had not been assigned to as auditing students, with the hope of gaining access to a free computer. (Tables 4 and 5)
- The predisposition, will and need of the children for continued education are worth noting (Table 8).
- Regarding the acceptance and completion of the tasks given, the children, in general, showed a wide acceptance of the activities proposed (Table 6). It is important to stress that, although many of the students had never used a computer, the practical applications were completed in due time and manner, exceeding the expectations of the teachers.

7. CONCLUSIONS

The socioeconomic crisis our country is going through strikes the city of La Plata and Gran La Plata with force. It is estimated that between 10 and 12 thousand people, mostly children, attend over 65 social diners created in the neighborhoods of the city. The children thus have access to what is likely only one ration of food, but also to school support, crafts teaching and integral work.

In a world in which we speak of computer “natives” and “information society”, there are still plenty of people which are very far from this reality.

This project, which has ended its first year of development, had surprising results. The degree of integration, acceptance and satisfaction from the children and the teachers and coordinators were more than satisfactory. The formative, qualitative and contextual evaluation processes were fundamental to improve and complement the teaching process, establishing a permanent articulation between the evaluation and training processes.

This undertaking has very significant qualities of great social impact, allows for an approach from the University to society sectors excluded from technological advances, and produces enormous satisfaction in teaching children and adolescents so eager to learn and improve themselves. It is another display of the interest of the University and this Faculty in establishing transcendental bonds with the community sectors excluded from the information society.

Although there are some similar initiatives in other parts of the country, in our region (La Plata and surroundings) it is the first project emerging from a Public University, presenting a formal framework and proposing a continuing line of work. These projects must be based on continuity, transcending successive managements, so the people involved rely on continuous training. The teachers will be able to plan in short, medium and long term and the students will be certain that their formation will continue year after year.

We consider that accessing technology must not be a privilege of a few – all children and adolescents should have permanent training and support plans to reduce the digital divide in the different sectors.

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SEEKING VALUE IN NETWORK COMPLEMENTARITIES. VALUE CO-CREATION PARADIGM FOR WEB 2.0 ERA

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ABSTRACT

In this paper we analyze the paradigm shift from value-creation through transforming objects (i.e., turning inputs into products) along a value chain to value co-creation through leveraging the webs of relationships in a value network. Underlying this shift are at least three key trends: from the 'publishing' to 'participatory Web, from integral to modular technology and application architectures, and from goods-dominant to service-dominant logic. These trends are not totally unique to the emergence of Web 2.0 but have been accelerated and intensified by it. We next examine the value network, identifying complementarities as the source of value and loose coupling as the network's strength. We next frame value co-creation in the business ecosystem context. The ecosystem metaphor allows us to tap into business ecology literature to offer theoretically grounded explanations and rationales for value co-creation and its strategic implications.

KEYWORDS

Web 2.0; value co-creation; business ecosystems; value networks.

1. INTRODUCTION

In a 2007 article, Manyika and colleagues at the management consulting firm McKinsey & Company described eight business technology trends to watch. In half of these, technology provides businesses radical new ways to harvest innovations from outside the corporate boundaries, engage customers as innovators, tap into vast networks of specialists and free-agents worldwide, and extract value from tacit interactions involving negotiations and conversations about knowledge and judgment, and from ad hoc collaboration (Manyika et al, 2007). These trends reflect a set of broader, more fundamental social, technological and economic trends. As the broader trends converge in recent years, they have also been intensified and accelerated by the emergence of Web 2.0. In turn, they have intensified a management paradigm shift from creating value through performing discrete economic activities along a value chain toward co-creating value through leveraging the complementarities among technologies, products and operations in a value network, which consists of market participants ranging from business partners to freelancing talents and the consumers at large.

Our primary purpose in this paper is to offer a conceptual analysis of the paradigm shift from value creation along a value chain to value *co-creation* through network complementarities. It will be carried out through a set of research questions. What are the key social, economic and technological trends underlying the paradigm shift, and how and to what extent do they reflect the transformational effects of Web 2.0? How does value co-creation paradigm differ from its value creation counterpart with respect to the source of value and the network structure? What are the strategic implications for market leaders seeking value in network complementarities, specifically in terms of network formation, system design and collaborative relationships among market participants? To address these research questions, we will draw theoretical insights from the

rich literature on modular technology and product architectures, service marketing, and business networks and ecology.

2. SOCIAL, ECONOMIC AND TECHNOLOGICAL TRENDS

The trends discussed below are not totally unique to the Web 2.0 era. Some features now associated with them can be traced to the earlier era. However, they have been accelerated and intensified by the emergence of Web 2.0.

2.1 From 'Publishing' to 'Participatory' Web

The term Web 2.0 was coined in 2004 during a brain-storming session by O'Reilly Media for a potential industry conference about the Web. The '2.0' designation tried to capture what appeared like a turning point for the Web, which O'Reilly (2005) later described in more detail as a series of transformational effects. The most widely publicized effect among them has been the rapidly multiplying volume of user generated content (UGC). In the previous era, the Web was a publishing Web where institutions (e.g., website operators, marketers and publishers) provided virtually all the content on the Web. In the new era, the Web has been transformed into a participatory Web where users can now be active creators, not just passive consumers, of content with the help of user-friendly applications such as wikis, blogs and photo sharing. In their rank is a growing number of serious and committed amateurs, referred to as 'pro-ams' by Leadbeater and Miller (2004), who contribute not only blog and wiki postings and creative multimedia content but also software applications and business solutions. They pursue such activities sometimes for potential monetary rewards, much more often for personal satisfaction, but with the dedication, skills and performance standards associated with the professionals. They power the proliferation of 'peer production' whereby the creative energy of a large number of people is channeled into large, meaningful projects through self-organization (Benkler 2001).

Supporting the participatory Web is the 'architecture of participation'. That architecture not only facilitates user participation but also, much more importantly, enables user interactions and collaborations such that services improve and content gets richer as more users participate (O'Reilly, 2005). As more users collaborate on a wiki page, for instance, errors and intentional bias can be detected and corrected more rapidly. Cook (2008) refers to this architecture as a 'user contribution system' -- a method by which contributions are aggregated and converted in real time, with little or no intervention by the firm, into something useful to others. Such a system creates value for a firm as a consequence of the value it delivers to users (e.g., personalized purchase recommendations as in Amazon and connections between sellers and buyers of hard-to-find items as in Ebay). The system creates value not only with active user participation but also with essentially passive contributions.

2.2 From Integrated to Modular Architectures

The architecture of participation is made possible by the lightweight programming model behind Web 2.0 applications. This model is based on modular technology and application architectures that let applications be specified as a set of function-specific modules (or components), interfaces (describing how the modules fit together) and standards (ensuring conformity to the overall design) (Baldwin and Clark, 1997). It offers interoperability of applications for easy deployment over the network, independent of operating systems and hardware devices (Legner and Lebreton, 2007). The applications often take the form of Web services. Traditionally, applications are created as integrated products -- every capacity is hard coded and tightly integrated; making even a minor change can be very time consuming and costly. By contrast, Web services are built as reusable, self-contained, function-specific software components. They can be selected, extended, combined and shared among different applications and business processes, allowing applications to draw services from different sources (Moitra and Ganesh, 2005). They are accessed through application programming interfaces (APIs) that enable developers to request services from an application without knowing its inner working or source code.

Modular technology and application architectures are generally believed as leading to modular industry architecture. They introduce new sets of design possibilities and thereby market-entry opportunities for new firms (Baldwin et al, 2006), permit a high degree of specialization in individual components and sharply reduce the need for centralized managerial control (Langlois, 2002), and shift the locus of innovation to the component or subsystem level (Pisano and Teece, 2007). These conditions lead to vertical disintegration of industries (Baldwin and Clark, 1997). Empirical findings by Schilling and Steensma (2001) support the link between product modularity and a migration toward modular organizational forms. This migration is observable in the consumer e-commerce sector where companies such as Amazon, eBay and Google have made their Web services and APIs publicly available. That has permitted tens of thousands of developers and entrepreneurs to enter the online business by building applications and stores that combine merchandise listings, inventory holdings, payment processing and mapping information from various sources. An example of that is WiiSeeker (wii.findnearby.net) that combines merchandise listings from several retail and consumer auction websites plus mapping service from Google to help consumers locate those merchants and local auctions having available the widely popular Nintendo Wii game console and accessories.

2.3 From Goods-Dominant to Service-Dominant Logic

Parallel to the rise of the participatory Web is that of services in the post-manufacturing economy. The goods-dominant logic underpinning the production of goods is being replaced by the service-dominant (S-D) logic underpinning the provision of services (Vargo and Lusch, 2004). In the S-D logic, the roles of production and consumption traditionally held by firms and consumers respectively converge. Consumers become co-producers and intimately involved in defining, shaping and integrating the service (Chesbrough and Spohrer, 2006). They act as collaborators with firms in co-creating value (Prahalad and Ramaswamy, 2004). Value co-creation is however more than decomposing a process and shifting part of the work from producers to consumers (e.g., self services) (Sheth and Uslay, 2007). Interactions between the two sides must offer an experience unique to individual customers, not just facilitating transactions (Lusch et al, 2008). Value is ultimately derived from participation of consumers through their use of the firm's offering, and is thereby essentially 'value-in-use' as opposed to 'value-in-exchange' (Vargo et al, 2008).

3. VALUE NETWORK

Because of the afore-discussed modular architectures, individual technologies, applications and firms do not create much value on their own. Instead, they depend on complementary technologies and products from other firms to be useful (Pisano and Teece, 2007). Recognizing this, the leading online social networks (OSNs) have all transformed themselves from being providers of a standalone service (social networking) to being architects of business platforms that harness the creativity of independent software application developers to co-create much greater value for users. It began with Facebook's decision to launch a development platform known as f8 in May 2007 so that independent developers could build applications interacting with Facebook core social network functions and potentially share in the advertising revenues from Facebook pages with their applications installed. These applications would help users accomplish more tasks without having to leave Facebook site. That would in turn make Facebook far more attractive to marketers. By November, Google (which owned an OSN named Orkut) responded with its own development platform known as OpenSocial. Unlike Facebook f8, OpenSocial was designed to be open and thereby interoperable with other OSNs that chose to support it (e.g., Bebo, Friendster, hi5, Ning, Plaxo and Six Apart, plus business-oriented LinkedIn, Xing and Salesforce). The leading OSN MySpace, after some initial reluctance, launched its own MySpace Development Platform, which also supported OpenSocial, in February 2008. The results to date have been 35,000-plus applications for Facebook by independent developers (compared to 19 by Facebook itself), 11,500-plus for Bebo and nearly 4,000 for MySpace (ProgrammableWeb, 2008).

3.1 Complementarities as a Source of Value

The business value of complementarities is well recognized in academic literature. Activities, products and assets are complements if doing (more of) any one of them increases the returns to doing (more of) the others. Complementarities thus indicate a condition of increasing returns (Chiu et al (2008). Teece (1986) posits that profiting from innovation requires both a core technology and relevant complementary assets. The latter can be generic, specialized (unilaterally dependent on a core technology) or co-specialized (*bilaterally* dependent). Unlike the latter assets, generic complementary assets generally offer little or no competitive advantage because they are readily available in the marketplace or easily developed. Amit and Zott (2001) find complementarities as a source of value creation by e-business firms. The architecture of participation and the S-D logic also help create an environment conducive to seeking value in such complementarities. The result is a paradigm shift from value creation by transforming objects (i.e., turning inputs into products) to value co-creation through seeking collaborations among market participants including customers. The frame of reference for value creation thus turns from the value chain to the value network (Peppard and Rylander, 2006).

In the traditional value chain analysis, popularized by Porter (1985), a firm seeks to position itself in those links where it can add more value at a low cost and thereby enjoys the most favorable performance gap over its rivals (Normann and Ramirez, 1994). The value thus created lies in the resulting products themselves. However, as products become dematerialized, the value chain concept proves less useful in uncovering value and analyzing value creation (Peppard and Rylander, 2006; Stabell and Fjeldstad, 1998). In a value network, a firm succeeds only by networking complementary technologies, products and market participants to co-create value. Value co-creation focuses on mediation (i.e., facilitating interactions and collaborations) among the networked participants (Fjeldstad and Haanaes, 2001). The value thus co-created lies not only in the core product or offering itself but also in externalities such as the ability to find meaningful and innovative complementarities that can be combined with it to develop strikingly novel offerings targeted at new consumer segments. The value of Google Maps, for instance, lies not as much in the database of geographical mapping information as in Google's ability to attract a large and growing number of complementing map-based applications and businesses.

3.2 Loose Coupling

Networks differ significantly with respect to the business relationships they embody and hence to their governance, member participation, connection and scope. At one end of the relationship spectrum are closely managed networks that feature prominently in supply chain management literature and business practices in the bricks-and-mortar world. They are built around long-term business relationships intended to be strategically important to the parties involved (Steiner, 2005). They have deliberately created structures, negotiated rules and goals, and a clearly identifiable powerful hub company controlling key resources and value activities (Moller and Rajala, 2007). Participation is exclusive to a few partners selected on the basis of their performance track records, service capabilities and professional qualifications (e.g., quality certification). They are necessarily confined to business-to-business collaborations driven by economic calculations (e.g., supply chain efficiency).

At the other end of the relationships spectrum are the value networks, which are the subject of investigation in this paper. They are loosely coupled networks that are more prevalent in the digital world and rapidly changing environment (e.g., disruptive technological innovations, blurred industry boundaries and shifting competition). Decision rights in these networks are widely dispersed and activities are 'orchestrated', rather than controlled, by some market leaders offering appropriate incentives for participation and defining standards for communications and interactions (Brown et al, 2002). Loosely coupled networks are therefore easily reconfigurable, self-organizing (Konsynski and Tiwana, 2005) and adaptive (Staber and Sydow, 2002). Participation is mainly through self-selection and open to the masses most of whom are individuals and small producers, professionals and amateurs alike.

Chesbrough and Principe (2008) relate network structure to the strategic objectives identified in March (1991) -- exploitation (seeking incremental changes to improve the firm's existing competences and strengthen its current competitive advantage) versus exploration (pursuing new business possibilities by developing new competences through radical innovations). An exploitation strategy favors a highly

structured, closely managed network featuring high-commitment alliances, strong ties and extensive equity cross-holdings so as to support intensive, long-term collaboration. An exploration strategy, on the other hand, calls for a network with loose coupling features -- low-commitment R&D alliances, weak ties and flexible inter-firm arrangements with provisions for an easy exit so as to reach out to more partners with diverse knowledge and capabilities beyond a firm's existing business. Similarly, Harryson (2008) finds strong ties are positively related to firm performance when the environment demands relatively high degree of exploitation (e.g., 'process networks' focusing on close alignment between R&D and marketing processes for new product commercialization); weak ties are more beneficial for exploration purpose ('creativity networks' focusing on specialized knowledge and technology).

4. BUSINESS ECOSYSTEM METAPHOR

The loosely coupled network through which market participants seek to co-create value resembles a business ecosystem in some key respects: self-organizing, complex and adaptive. The ecosystem metaphor helps tap into the rich literature on business ecology, evolution economics and complexity theory. It provides well grounded theoretical principles on which to frame our understanding of value co-creation.

4.1 Self Organization, Common Fate and Collective Health

A business ecosystem is 'an economic community supported by a foundation of interacting organizations and individuals — the organisms of the business world' (Moore, 1996). Its species are unique but interdependent on one another for their mutual effectiveness and survival (Iansiti and Richards, 2006). It is a self-organizing system, constantly remaking itself in response to environmental changes and to the needs and actions of its members. Through self-organization emerges a complex adaptive system (CAS) that is capable of transforming itself in a fundamental manner, not just in incremental changes. Complexity arises not from the large number of members making up the system but from the countless ways in which they can interact with one another and with the environment. Because of it, a CAS behaves in a non-linear fashion -- an action by one member does not lead to a single outcome in a deterministic way typically found in a mechanical system but may instead cause a variety of subsequent actions. Without strong cause-and-effect linkages between individual actions and long-term system outcomes, it is difficult for any member to control or design specific systemic behavior; instead systemic behaviors simply emerge (Choi et al, 2001; Ethiraj and Levinthal, 2004). Emergence is the manifestation of new systemic properties due to collective behavior of network members. It occurs because self-organization allows experimentation, rule breaking and exploratory actions, which gives a system its ability to adapt to changes, often by producing novelty and innovation (McCarthy et al, 2006).

Given the interdependence among the species, actions by one species may affect some other species and the overall health of an ecosystem, and that will ultimately affect its own performance. This is known as common fate: all species inhabiting the same ecosystem benefit from a healthy system and suffer from an unhealthy one regardless of individual species' apparent strength (Iansiti and Levien, 2004). An ecosystem's collective state of health can be measured by its productivity (ability to transform technologies and innovations into products and services), robustness (ability to cope with disruptive and unforeseeable changes), and innovation and niche creation (ability to support diversity of species and thereby to enable emerging technologies to be turned into a variety of new products and businesses) (Iansiti and Levien, 2004; Iansiti and Richards, 2006).

4.2 Strategic Implications

To help maintain a healthy business ecosystem, market leaders should act as keystone species, or enablers, rather than dominators (Iansiti and Levien, 2002). This goes against the conventional thinking in strategic management that tends to favor control and domination over key value-adding functions so as to appropriate the maximum value from the system, leaving less for other players to extract. This kind of thinking applied to the ecosystem paradigm may eventually squeeze out complementors (providers of complementary technologies, products and services), undermine the system's diversity of species and collective health, and

in the end the well being of the dominator itself. Instead, a firm may pursue market leadership as a keystone, providing a stable and predictable set of common assets and standards so as to let complementors build their own offerings and innovate, and thereby to facilitate niche creation that would boost the ecosystem's robustness. Facebook exemplifies this keystone strategy with its launch of the f8 development platform and the tens of thousands of applications it has attracted. A keystone strategy can improve the system's productivity by simplifying the task of connecting participants. It can also further boost the system's robustness by providing a reliable point of reference that helps participants create new connections and thus respond effectively to new opportunities or uncertain conditions. Facebook members not only can access external services from within this OSN via widgets and mashups, but they can also harness information and recommendations from their circles of friends on a wide range of matters, from nightlife to shopping. In short, a keystone leads by its ability to provide fertile opportunity space for complementors to innovate.

Consistent with a keystone strategy is a lean-core system design. 'Leanness' comes from the fact that the market leader does not try to capture or to create too much value on its own, but instead relies on complementors for the missing elements to bring the system to a high degree of functionality, thereby allowing it to scale up and evolve rapidly and cost-effectively (Orellos, 2008). In such a system, the costs, risks, intelligence and initiatives are pushed to the edge where many providers of complementary technologies, products and services (or 'complementors' for short) are located, innovations pursued, new products and services developed and new markets explored (Iansiti and Levien, 2002).

A lean-core system design is also congruent with the emerging trend in 'open innovation' -- 'the use of purposive inflows and outflows of knowledge to accelerate internal innovation' (Chesbrough, 2003). Open innovation is modeled after a 'bazaar', instead of a 'cathedral', to use the metaphors with which Raymond (1998) contrasts between open-source and proprietary software development models. The cathedral model relies on 'individual wizards or small bands of mages working in splendid isolation' or, in business terms, on teaming up with a few highly qualified suppliers and partners to ensure greater supply chain performance and possibly to pre-empt or limit competition from accessing the latter's capabilities. The bazaar model on the other hand recognizes the vast pool of talents residing outside the firm, which can be a valuable source of ideas, solutions and innovations. It therefore favors making the best use of both internal and external sources of knowledge and creativity. Adoption of the bazaar model can be found beyond the open-source software movement. An example is the 'connect and develop' (C&D) initiative by Procter and Gamble that has enabled this market leader in the consumer packaged goods industry to introduce more than 35 percent of its new products containing solutions from the outside. The company now plans to boost this ratio to 50 percent by with the help of external venues such as InnoCentive -- 'Open Innovation Marketplace' that matches organizations with challenging R&D problems and independent ad-hoc experts offering possible solutions (Howe, 2006).

5. CONCLUSION

Our conceptual analysis in this paper contributes to a small but expanding pool of business management research on Web 2.0. We focus on the paradigm shift from value creation along a value chain to value co-creation through network complementarities. Drawing from a diverse and interdisciplinary literature on modular technology and product architectures, user participation and service marketing, we identify three fundamental trends that underlies the value co-creation paradigm -- a shift from the publishing to participatory Web, a shift from integral to modular technology and application architectures, and that from G-D logic to S-D logic of marketing. While these trends are not totally unique to the emergence of Web 2.0, they have been accelerated and intensified by it. We next analyze the value co-creation paradigm, making the case for network complementarities as a source of value and loose coupling as the strength of value networks. Loosely coupled networks are highly reconfigurable, self-organizing and adaptive, and thereby more suitable than highly structured, tightly managed networks in exploring rapidly emerging business opportunities and coping with fast changing digital world in the Web 2.0 era. We then frame value co-creation in the business ecosystem context. The ecosystem metaphor offers an alternative to the Newtonian view of business as an orderly and predictable world that operates in a deterministic way like a machine governed by immutable laws. The Newtonian view has for decades featured prominently in management and classical economic thinking. A complex and less deterministic view of value co-creation represents more realistically the world

of business in the Web 2.0 era. It also helps us draw insights from business ecology literature to develop theoretically grounded explanations and rationales for value co-creation and its strategic implications. Academic research on Web 2.0 is still in the nascent state. We hope that this paper will make a small contribution in delineating the transformational effects of this phenomenon.

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A MODEL OF DIFFUSION PARAMETER CHARACTERIZING SOCIAL NETWORKS

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ABSTRACT

We introduce a new diffusion property that can be used to characterize different models of social networks; the Diffusion Characterization Parameter α . The parameter is related to information diffusion within the network. Each social network model is found to have a different characteristic value: Random $\alpha = 148$, Small-World $\alpha = 4.56$ and Scale-Free $\alpha = 1.50$. An example of a virtual friendship social network has a value of $\alpha = 29.58$ which makes it a random small world network.

KEYWORDS

Diffusion, Social Network, Adoption rate, Bimodal map

1. INTRODUCTION

Social sciences focus on the structure of different groups such as human groups, communities, markets, societies or the entire world system. A social structure is a network of social ties and a social network is on the other hand a set of individuals (organizations or social entities) connected by a set of social relationships, such as friendship, co-working relation or information exchange. Social network analysis assumes that interpersonal ties are important, as the ties among organizations and countries, because they transmit behavior and attitude, information and goods. Social network analysis focus on the analysis of the existing patterns of relationships and ties among social entities [1]. Therefore, the individual is not the basic social unit. The social atom consists of the individuals and their interpersonal social, economic, or cultural ties. Social atoms are linked into groups and interrelated groups and eventually forming a society. Social network analysis might be applied on different social relationships and units for example Anthropologists study the kinship relations, friendships, and gift giving among individuals; Social psychologists focus on affections; Economists investigate trade and organizational ties among firms [2]. In social network analysis, an individual is referred as an *actor* and therefore, social network analysis is a way of studying the social ties among actors.

There are several models of representing social networks such as mathematical models, graphical models (visualization), matrix models and statistical models. The mathematical and the graphical models are the main models that are mostly used by researchers to represent social networks. The mathematical model uses formal mathematical representations which allows us to use computers in analyzing the social networks. Also the mathematical techniques themselves may suggest things that we might be looking for in our data [2]. The other model is visualization using graphs and graphical models to analyze a social network. In this model, graph nodes represent actors and edges represent ties among those actors and these kinds of graphs are called sociograms [1]. Visualization of a sociogram with sufficient information related to actors and their ties is an easy and common way of representing social networks but we always have to keep in mind that our eyes could be easily fooled and a network could be drawn in many ways. Therefore, the visualization (or drawing) techniques must follow a meaningful pattern in order to represent the actual behavior of a network. For example the distance between two nodes, the length of an edge and the location of a node in the graph and other features of the network might provide different meanings. So, visualization must follow standard rules in order to have a meaningful representation.

The diffusion process is an important property of any social network. The diffusion process is the movement of information, diseases or innovations from one member to other members through social ties and relations within a social network. However, people are always interested in not acquiring contagious diseases, administrators are interested in diffusion of information and market leaders look for distribution of new products. Hence, the diffusion process is important in the social process and people always want either to disperse and spread their ideas and goods among the society or protect themselves from getting infected by harmful matters.

Diffusion in social networks is considered as a special case of brokerage that has a time dimension. Information, opinions and diseases are handed from one person to another person within a network in a course of time. In a social network, interpersonal relations are channels for social contagion and persuasion. Therefore, the structure of the interpersonal ties is relevant to the diffusion process regardless of the characteristics of the actors. In fact, the characteristics of an actor do not make it more open to innovation than the other. The position of each actor in a network and its ties are the main factors that make it more open to the diffusion process or not. For example, in the Kuwaiti society, which is a small society where individuals within it are highly connected and have strong ties among them. A Kuwaiti person could be an actor in several social networks such as family, colleagues, coworker groups, childhood friends, and etc. Individuals within those groups see each other so often and always share news, social matters and daily events. These strong interrelated ties among individuals within a group could be more than enough to disperse a new technology among those people. For example, assume that you meet a colleague at work and tell him about a technology such as Bluetooth. Then he would go home and share the new information with his family members (Family group). Later that day, he might meet his friends at the coffee shop and tell them about the new technology (Friends group) and so on. Therefore, it is possible that within a short period of time, this new technology starts to spread among different groups within the society. Most studies about diffusion focus on pointing out the factors that lead people to adopt or deny a new idea within a society. Others discuss the time dimension of the diffusion process in a sense that helps them toward discovering why some people adopt a new idea earlier and others take longer time. Several mathematical and network models are used to study the diffusion of innovations.

In this study, we are going to analyze some social network properties for different network models such as Random, Small-World, Scale-Free and Real Social Networks. Our aim is to calculate and determine the “Diffusion Characterization Parameter α ”, within any given network by knowing the network structure and relations along with some other properties such as the relations directions.

2. NETWORK MODELS

In this study, four different network models are going to be analyzed and studied: Random, Small-World, Scale-Free and Real Social network models. Each network model is created based on specific rules and might have different properties than the others. However, they all represent network models and they all contain nodes and relations. In the following sections, these four network models are described in more detail and examples are represented to provide a better understanding for each network model.

2.1 Erdős and Rényi Random Network

One of the most basic and popular models of random complex networks is the Erdős and Rényi model introduced in 1959 [10, 2, 3]. In this model, a network with N nodes is constructed along with a probability p for connecting each pair of vertices in the network, excluding duplicate or self looping links [10]. The resulting network represents an Erdős and Rényi random network. Figure 1 represents an Erdős and Rényi network with 30 nodes and average degree of 3.

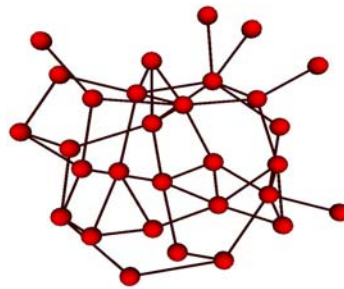


Figure 1. Erdős and Rényi network with 30 nodes and average degree of 3.

In this study, we are going to refer to the Erdős and Rényi network model as the Random Network Model. There are other ways to create random networks such as creating N disconnected nodes and then creating M edges that are distributed randomly among pairs of nodes. The result will be similar in both ways.

2.2 Small-World Network

In 1967, Milgram made a famous experiment and found that two random chosen US citizens can reach each other through an average of six social links [4]. In other words, he found that in a social network, everyone in the network could be reached through a finite number of edge transitions [5, 6]. This concept is called the Small-World property, and therefore, the Small-World network model is defined as a network which has the Small-World property. Another property of the Small-World networks is the existence of a large number of loops of size 3 links, i.e. if node a is connected to b and c , then it is highly possible that b and c are also connected to each other forming a cluster of 3 links. A famous random network model which satisfies the Small-World property and has high number of small clusters is the Watts-Strogatz (WS) *small-world model* [7]. To create a (WS) Small-World network, we start with N nodes, where each node is connected to k neighboring nodes in both directions forming $2k$ neighbors. Then, each edge in the network is rewired based on a probability p . The resulting network looks similar to the network shown in Figure 2, for a network of 30 nodes, $k=2$ and $p=0.3$.

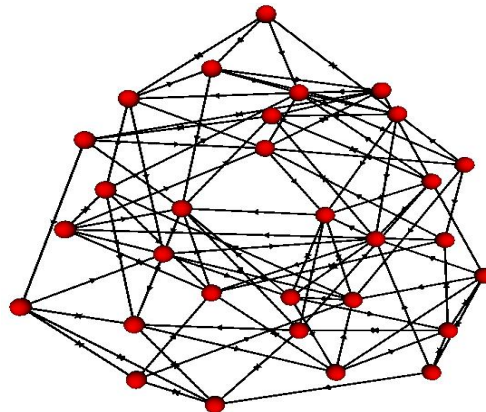


Figure 2. Small-World network with 30 nodes, $k=2$ & $p=0.3$.

In this study, we refer to the (WS) Small-World network as the *Small-World* network. As shown in the Figure above, each node is connected to 4 other nodes ($2k$) through directed links and note that the applied rewiring concept does not change the number of outgoing links from each node.

2.3 Scale-Free Network

Many studies had shown that the degree distribution for many real social networks do not follow a unique pattern, instead they showed that it follows an uneven distribution. Barabasi and Alberts [8, 1] showed that in many systems, there are few nodes in the network that are highly connected while the others have much less

connections. These few highly connected nodes represent hubs in the network and they have a large fraction of the existing relations in the network. A network with the mentioned characterization is called a *Scale-Free* network. Scale-Free networks are built following a growth pattern. First, the network starts with $M0$ random nodes with random relations between them. Then the network grows by adding new nodes to the existing network and creating more relations between the newly added node and some of the previous nodes. Adding a new relation between a new node i and an existing node j is proportional to the total *in* and *out* degree of j . The probability of creating a link between node i and node j is represented by the summation of all *in* and *out* degree of j over the total degree for the network [9] and is given below:

$$p_{i \rightarrow j} = \frac{\sum Degree(in,out)_j}{\sum Degree(in,out)_{network}} \quad (1)$$

Figure 3 illustrates a scale-free network with 30 nodes, initial population of $M0=9$ nodes and connecting probability of $p=0.1$.

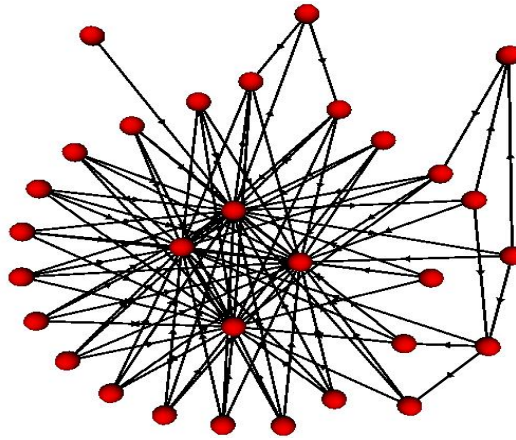


Figure 3. Scale-Free network with 30 nodes, $M0=30\%$ & $p = 0.1$.

As shown in the Figure 3, all the nodes are connected in the network and no isolated nodes exist. This is a result of having relatively smaller connecting probability p . Also you can notice that there are four nodes in the middle of the network that almost every other node is connected to, forming hubs for the network. These nodes tend to have highest degree when the network was initialized and therefore, they will have more relations toward them after adding the new nodes to the network.

3. DIFFUSION CHARACTERIZATION PARAMETER α

The diffusion process follows an empirical pattern similar to spreading an infection among people as mentioned in the previous section. Starting by a single infected source, the innovation/disease is dispersed to the neighbors of the source at the first level. Then, each new adopter is going to spread the innovation/disease to its neighboring nodes at the next level and their neighbors are going to pass the innovation/disease to their neighbors in next levels and so on until almost all the nodes in the network are infected and adopted the innovation/disease. Based on some properties of a source such as the location and connection degree, the diffusion process will change and the percentage of adopters after each level might differ. However, the adoption rate curve will always follow a typical S-shape for all the sources as shown in Figure 4. The adoption curve for two different selected nodes is shown in Figure 4, a central source node which is located in the center of the network and has more connection to its neighbors in the network and a marginal source which has fewer connection to other neighbors respectively.

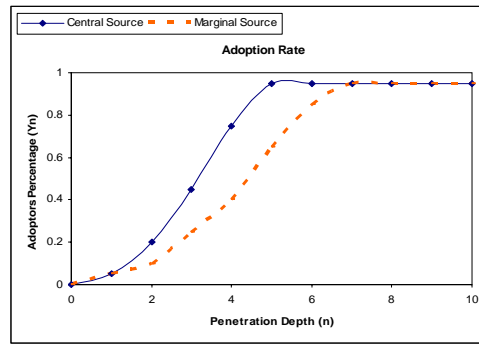


Figure 4. Adoption rate for a network with 20 nodes and two different selected sources.

The penetration depth n specified in the above Figure defines the distance between the source and the infected nodes in number of links after applying the diffusion process. For example, at $n=0$ only the source is infected and at $n=1$, all the nodes that have direct link from the source are going to be infected. At $n=2$ all the infected neighbors' neighbors are going to be infected and so on until almost all the nodes are infected or are not reachable. The Diffusion Characterization Parameter α is calculated through a non-linear regression model which is used to minimize the summation of the square difference for the Adoption Percentage Y_n by changing the value of α at penetration depth n and $n+1$. The equations are given as follow:

$$\text{Minimize } \sum_{n=0}^{n-1} [Y_{n+1}^2 - Y_{n+1}^2(Eq)] \quad (2), \quad \text{where } Y_{n+1}(Eq) = \frac{\alpha Y_n}{1 + (\alpha - 1)Y_n} \quad (3)$$

In the following sections, we are going to analyze the diffusion characterization parameter α for the three different network models Random, Small-World and Scale-Free network models. For each network model, we are going to generate two graphs: Adoption rate graph and the Bimodal map for Y_n & Y_{n+1} . Average α for all sources is represented in the next sections. The adoption rate graphs represent the cumulative percentage of adopters versus penetration depth when starting at a selected source node. The bimodal map shows the relation between Y_n & Y_{n+1} .

3.1 Random Network Model

The test is run for a Random network with $N=50$ nodes, the resulting adoption rate is given in Figure 5 and it shows that it follows the S-shape previously described but with different rates since the network is randomly generated and has random relations between nodes.

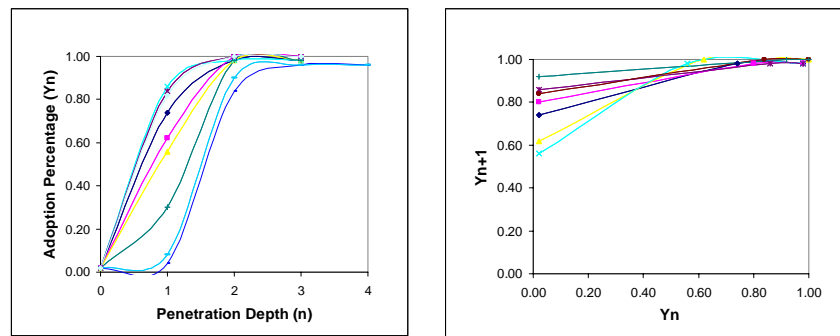


Figure 5. (a) Adoption rate curve for 10 random sources in a Random network with $N=50$. (b) Bimodal map for 10 random sources in a Random network with $N=50$.

The maximum penetration depth is $n=4$ with an average value of $n=3$. The bimodal map in Figure 5 shows that the adoption rate is increasing rapidly at the early stages and it will converge to a unique value after the 2nd or 3rd steps respectively. The average value of α calculated using the Bimodal map equals 148 and it spans for randomly selected different initial sources between 20 and 1000.

3.2 Small-World Network Model

For the Small-World model, there are two more parameters that must be specified before running the tests: the number of neighbors at each side k and the rewiring probability p . The test is run for a network with $N=50$ nodes, $k=2$ ($2k$ total neighbors) and $p=0.5$. The adoption rate is given in Figure 6 with a maximum penetration depth of $n=7$ and an average value of $n=6$. The adoption rate curve shows that almost all the nodes have similar properties since the curve is almost identical and the difference is small comparing to other networks.

The test shows that the adoption rate is similar when starting at any random source within the network. The resulting bimodal map will have a smooth representation showing a high value at the beginning and a uniform decrease after each step till converging to the maximum value. As described before, all nodes have similar properties and the resulting α for different nodes is almost a constant value equals 4.56 (Figure 9).

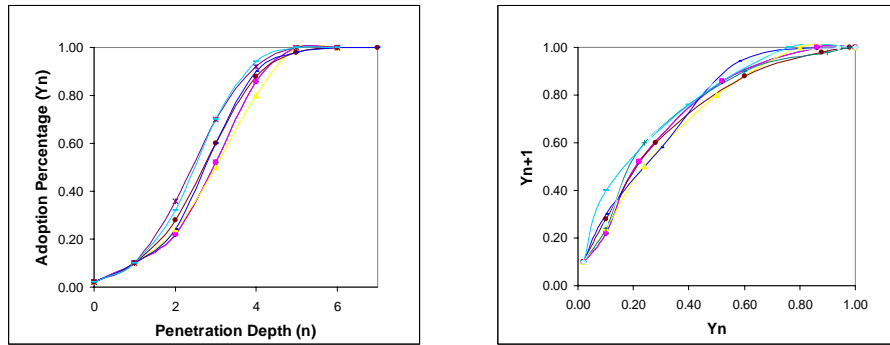


Figure 6. (a) Adoption rate curve for 10 random sources in a Small-World network with $N=50$, $k=2$ & $p=0.5$. (b) Bimodal map for 10 random sources in the Small-World network with $N=50$, $k=2$ & $p=0.5$.

3.3 Scale-Free Network Model

Similar to the Small-World model, the Scale-Free model has two parameters that must be initialized before running the tests: the number of initial random population $M0$ and the connecting probability p . The test is run for a network with $N=50$ nodes, $M0=40\%$ (40% of the initial population is randomly created) and $p=0.06$. The adoption rate is given in Figure 7 with an average penetration depth of $n=3$. The adoption rate curve follows an S-shape similar to the random and small-world models. It converges to 0.4, which is the initial population ($M0=40\%$) after 3 levels of penetration. This is a predicted result since the initial population is randomly created and contains nodes with higher degree of links, forming a central partition in the network where all links come toward it. This will lead most of the newly added nodes to be connected to the nodes within the initial population.

The bimodal map for this Scale-Free network is similar to the adoption rate in behavior. It has a shape similar to the random model for the first 20 nodes since they are randomly generated and form a random network. for the rest of nodes, it forms exactly the same curve since they are all connected to the same nodes and have exactly the same adoption rate. The value of α equals 1.50 spanning in a narrow range of 1.11 and 1.67 for different randomly selected sources.

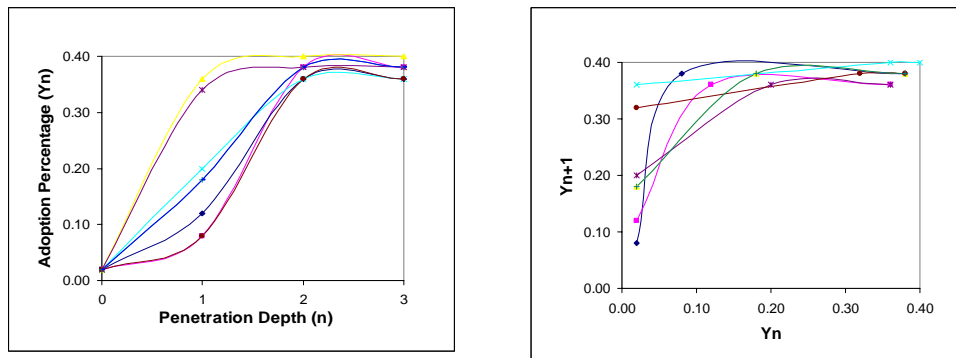


Figure 7. (a) Adoption rate curve for 10 random sources in a Scale-Free network with $N=50$, $M_0=40\%$ & $p=0.06$. (b) Bimodal map for 10 random sources in the Scale-Free network with $N=50$, $M_0=40\%$ & $p=0.06$.

4. DISCUSSION

Table 1 summarizes the diffusion characterization parameter for different social network models. A Virtual Friendship Social Network with 2393 nodes was analyzed to find its α values (Figure 8) and it has an average value of 29.58 for all nodes. Figure 9 shows the values of α for 50 randomly selected source with a range between 5.72 and 99.87. the resulting α for the virtual friendship social network falls between the small-world and the random network models. Figure 9 illustrates the diffusing characterization parameter α for all models discussed in this paper.

Table 1. Diffusion Characteristic Parameters for different social network models

Network Model	α	Range
Random	148	20 - 1000
Small-World	4.56	3.40 - 6.00
Scale-Free	1.50	1.11 - 1.67
Virtual Friendship Network	29.58	5.72 - 99.87

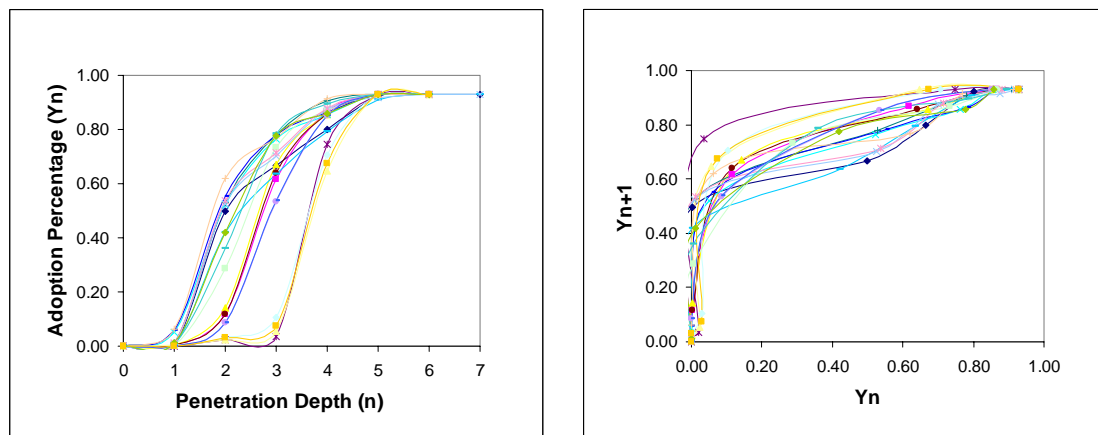


Figure 8. (a) Adoption rate curve for a virtual friendship network with random sources and 2393 nodes (b) Its corresponding Bimodal map.

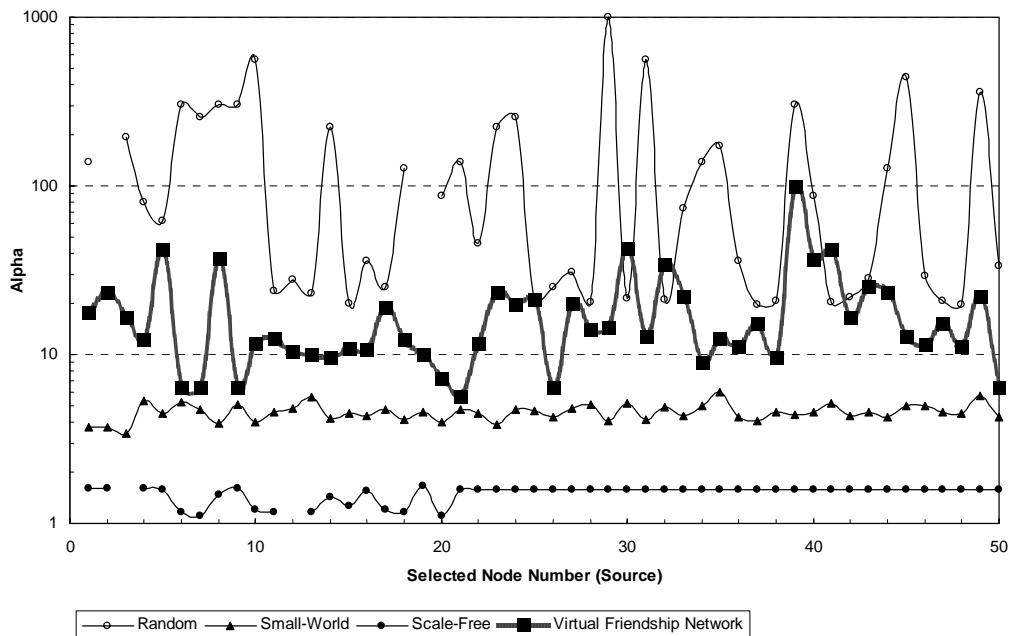


Figure 9. α values at different initial selected nodes, randomly selected information source.

5. CONCLUSION

A newly proposed characterizing property for social networks is introduced based on diffusion principle. We coin the property the Diffusion Characterization Parameter α . The parameter is found to have a unique value for each social network models discussed; random, small-world and scale-free. A virtual friendship network's diffusion characteristic parameter is determined and its average value equals to 29.58. It suggests that such network is somewhere between a Random and a Small-World network. We refer to as "Ransom Small World". We conclude that virtual friendship social networks are not purely small-world network as been suggested in the literature however; they are small world with randomness implicitly existing in its topology.

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KNOW-HOW TRANSFER METHODOLOGIES WITHIN OUTSOURCED PROCESSES AND GLOBAL PRODUCTION FLOW

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ABSTRACT

Global production processes over the last few years heavily deploy outsourcing, often across orders, thus introducing the concept of the virtual, modular enterprise; production steps may be executed by independent service providers and often involve the participation of SMEs. This trend is especially evident in the manufacturing sector, in which outsourcing production cycles are worth 150b Euros worldwide. Furthermore, after the EU expansion outsourcing in the European manufacturing sector often involves companies in the new member states, providing an important economic development vehicle. Despite the economic benefits it involves, outsourcing introduces new requirements in terms of skill development and know-how transfer from the outsourcer to the client aiming at quality assurance and interoperability of distributed production processes. While standardization facilitates harmonization of skills in the formal VET training system, outsourcing often involves transfer of on-the-job knowledge in informal settings. Skill development requirements in the context of distributed process management may not be adequately met by traditional training methods that involve face-to-face demonstration followed by hands on practice. This paper reports work in progress targeting new methodologies for skill development in global production contexts that fully exploit the advances in virtual communications and networking technology. It utilizes video communication to improve communication; facilitate semantic interoperability in multilingual and multicultural production environments, and skill development-related costs.

KEYWORDS

Outsourcing, methodologies, training, know-how, quality assurance, certification, video

1. INTRODUCTION

Outsourcing has enabled companies in Europe to turn around their processes and reinforce their competitiveness in the world markets. Outsourcing has allowed companies to become more modular: entire departments or processes may be managed by 3rd parties acting as virtual subsidiaries.

However, the outsourcing cycle is far from efficient and inter-company quality assurance processes still introduce challenges. This gap in the outsourcing industry is being partly addressed through EU directives, harmonized standards, and educational guidelines aiming at smooth cooperation; these standards promote new production systems where outsourcing of knowledge-based production is frequently used as a necessary process. While these measures are a step in the right direction, know-how transfer in the context of quality assurance of outsourced processes is still not properly addressed within management of the distributed virtual

subsidiaries. The result is a steady increase of expensive product recalls that effectively slow down the modernization of industrial production systems and technologies.

This observation is especially evident in the European manufacturing industry, which is the 2nd largest sector in the extensive use of outsourcing covering 150b Euros worth of contracts worldwide. In this environment, companies do not only sell products, but also know how and processes; large companies need to transfer their internally developed know how to SMEs that are recipients of outsourcing contracts.

The regulated European manufacturing industry enhances a new market for trans-national on the job know-how competence transfer where effective, possibly remotely located in-company skills upgrading processes and mentoring/tutoring solutions constitute critical business activities within successful production frameworks.

This paper presents new competence transfer models and skill development principles for organising, delivering, and deploying effective production technology transfer intra- and inter-company, as well as towards VET schools. The paper presents work in progress for establishing new models for delivering in-company skills development processes that significantly reduce the costs related to technology transfer and enhances production competence transfer. The proposed framework extends the existing formalised vocational training system, and the informal transfer of know-how usually practiced in companies through an innovative combination of virtual blended learning environments. This environment utilizes educational video content delivery, state of the art principles for learning design and learning activities, and coordinated active feedback of knowledge exchange for peer-to-peer corrective actions in direct production through videoconferencing/video streaming technologies.

2. THE EMERGENCE OF OUTSOURCING AND THE “VIRTUAL, MODULAR ENTERPRISE”.

Outsourcing of production has nearly taken place as long as the industry has existed. The background for the outsourcing can vary, from pure cost/benefit reasons, time to market considerations or other strategic interest considerations.

Whatever is the cause for the outsourcing, some general problems may occur depending of what type of outsourcing we deal with and the technological complexity of the product to be outsourced.

"Outsourcing" involves transferring or sharing management control and/or decision-making of a business function to an outside supplier, which involves a degree of two-way information exchange, coordination and trust between the outsourcer and its client. Such a relationship between economic entities is qualitatively different than traditional relationships between buyer and seller of services in that the involved economic entities in an "outsourcing" relationship dynamically integrate and share management control of the labour process rather than enter in contracting relationships where both entities remain separate in the coordination of the production of goods and services. Many companies outsource manufacturing and engineering.

It is apparent that many organizations today are making the decision to outsource. In today's global marketplace outsourcing has made itself accessible to many organizations on a National and International level. Outsourcing has provided many businesses with the opportunity to harvest the benefits of lower labour costs and to exploit the value of less than par foreign currencies. Through outsourcing, companies today have the ability to develop competitive strategies that will leverage their financial positions in the ever competitive global marketplace. Outsourcing may also be successful in increasing product quality and/or substantially lowering firm and consumer costs (e.g., increases the quality to cost ratio). Because outsourcing allows for lower costs, even if quality reduces slightly or not at all, productivity increases, which benefits the economy in aggregate.

Some of the major advantages that today's organizations can expect to obtain through outsourcing include the ability to purchase intellectual capital, to focus on core competencies, to better anticipate future costs, to lower costs. Overall outsourcing is viewed by many organizations as a strong business tactic that ultimately is a superior economical approach to developing products and services.

Outsourcing extends the traditional view of enterprises. It introduces the concept of the virtual and modular enterprise where production process steps are executed often in a distributed manner which may involve partners across borders.

2.1 Outsourcing Cultures and Emerging Skill Development Requirements

Today's global competitive business environment has made the culture of an organization a critical aspect of its success (Sadri 2001). Culture is commonly identified as "a set of mores, values, attitudes, beliefs, and meanings that are shared by the members of a group or organisation", and is often the primary way in which one 'group' (organisation, team, etc) differentiates itself from others (Williams 1993, Duarte 2001). Unfortunately, little attention is paid to the practical, day-to-day process involved in creating, managing and changing culture (Williams 1993). Every organization within the industry has its own unique culture, sub-culture, character, nature, and identity. It has its own history of success and failures, which reinforces or challenges the organization's 'way of doing things'. Older and more successful organizations, for example, are said to have stronger cultures, natures, and identity (Meudell 1994, Schneider 2000). Yet, despite the growing awareness of various cultural issues, little attention is paid to the practical, day-to-day process involved in creating, managing and changing culture (Williams 1993).

The distributed nature of the production process introduces advanced needs in terms of know-how transfer in an international environment. Processes must be harmonized and standards must be followed. The above are easier to comply with in the context of formal training. However, outsourcing involves the transfer of on-the-job developed know-how from one company to another for the execution of specific tasks the outputs of which must be interoperable in a wider production chain.

Traditionally, outsourcing challenges involve cost control. The relationship with a company and outsourcer can be extremely tense if the expectations of performance differ between the outsourcer and the client. Fortunately this is a topic that can be addressed by the client. To avoid this it's critical to invest in the required time and other resources for skill development upfront as well as to select a partner that has both the capability and the motivation to achieve objectives

Skill development design must also address the need for a certain level of integration between the company and outsourcer's operations to keep communications strong, expectations met, and best practices shared. It is important to create a relationship that allows for ongoing dialogue to occur with several levels of the in-house team. Although outsourcing is less resource intensive than managing it internally in the long run, it does require assigning resource internally to streamline communication channels as well as skills.

On the other hand, the manufacturing industry culture may vary significantly across cooperating companies. These cultural differences may cause cooperation problems that are likely to appear over time and it may be difficult to observe it in the very beginning of the cooperation.

The above introduce the issue of "semantic interoperability" in the context of global production processes. Engineers in the manufacturing sector often point out the issue of using the same words to describe different processes, even at a time where significant efforts are made towards standardization. This may be especially accentuated across borders and continents where standards may vary.

Manufacturing is a sector in which know-how is typically transferred through demonstration. While this model works well intra-company, it may be challenged by obstacles introduced by the simple fact of distributed production within global production processes. Simple text-based presentations cannot replace face-to-face instruction and the use of static images may still fall short of meeting communications requirements. Engineers typically complain that concepts must be communicated by faxing demonstrative images, with the original being returned full of notes and questions. Thus, skill development and communication in a distributed production process requires know-how transfer methodologies that overcome the shortcomings of traditional methods.

3. FORMAL AND INFORMAL KNOW-HOW TRANSFER METHODOLOGIES IN GLOBAL PRODUCTION FLOW

3.1 Activities Based Training

Traditional training methodologies in the manufacturing sector frequently require that students follow theoretical instruction followed by hands-on training and welding practices.

Activities Based Training (ABT) however, utilizes training that is closely connected to the actual production activities as there are defined through job packages with the production path of a predefined structure or product. The basic idea is that the contents are available when needed, so that the student is able to proceed to the related training element. It is foreseen that different delivery technologies may be used for transfer of the learning material itself in order to create a more engaging and motivating educational environment. This way the student can access educational material delivered as learning objects in different media formats, such as text, video, images, etc... Learning objects are standardized for delivery through learning management systems or other infrastructure for the dissemination information.

Our research focuses on the deployment of ABT methodologies in order to improve skill development in fabrication. ABT applies training closely connected to the actual production activities as these are defined through work packages with the production path of a predefined process or product. Various training delivery technologies may be used in combination with ABT to create a more engaging and motivating educational environment.

The following figure displays the logical steps of a training activity for a specific process, organized through the ABT paradigm.

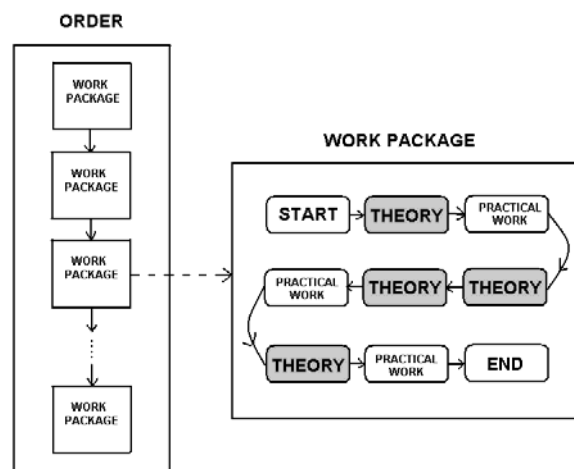


Figure 1. A mechanical industry order contains a number of work packages.

As shown in figure 1, the course utilizes work orders. An order is divided into several logical elements (work packages), which follow the fabrication and production process. A work package is comprised of a series of learning elements, which can follow independent learning design. They may involve pure theory or combine it with hands-on training. The example revolves around harmonized contents as these are defined in the document IIW IAB-089-2003/EFW-452-467-480-481, the Guideline for the International Welder Education by the European Welding Federation and creates a framework for harmonized education in Europe as well as internationally. Third party verification performed either by the teacher or by other learners follows practical training to facilitate validation of outputs and raise responsibility awareness among learners.

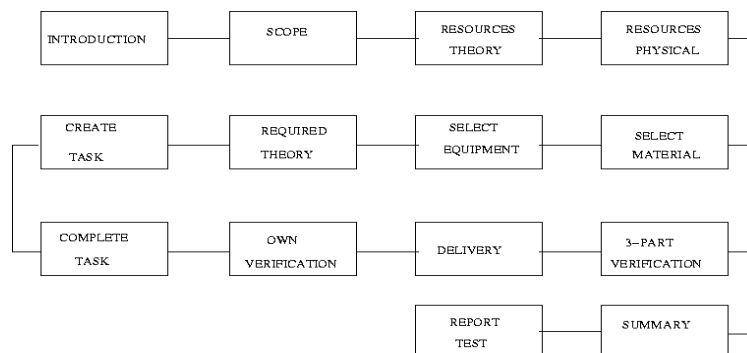


Figure 2. The general design of one course module within the ABT methodology

Figure 2 displays the general design of a course module based on the ABT paradigm. During the course the teacher presents the students with new tasks which are structured as work packages, in order to adapt to the natural production workflow. Students may be assigned different roles in this scenario, with responsibility for different actions. The training can be delivered either as on-site training where the teacher uses the course modules in classroom training, or partly as a distance-learning course. In the latter approach, the students access training, education and learning material through extended blended learning training environments using Internet, various e-learning technologies, as well as state of the art visual communication and collaboration technologies.

3.2 Blended Learning towards Inter- and Intra-company Training Delivery

It is expected that learners participate in skill development programs while working in the industry. For this reason, the training delivery method must take into account limitations in terms of time and location. It should further be noted that in a professional environment learners can benefit from each other's knowledge and skills, as much as through the interaction with an instructor. Thus, the social part of education becomes an increasingly important factor.

For the above reasons, we proposed Blended Learning training delivery methodologies that deploy a combination of channels for know-how transfer, and specifically:

- In-class formal instruction
- Visual technologies-based distance communication
- Hands-on practical training
- Self-paced learning

In-class instruction is ideal for theoretical, standards-based education and has the best results when combined with hands-on practice under in real-life conditions focusing on specific jobs, tasks, processes and materials under the supervision of an expert. Self-paced learning allows the retrieval of information from a library of learning objects or from sequences of training modules in a more general course structure. Sequences may be short sub-courses, or course elements within a smaller domain.

It should be noted that face-time (that part of the training where the instructor and the students may use oral communication) is very important for information exchange among professionals. Taking this into account, visual communications technologies can significantly increase face-time and complement in-class instruction as a know-how sharing tool facilitating both formal and informal knowledge sharing. The importance of visual communications tools and their integration into ABT and Blended Learning practices will be further detailed in the sections below.

Blended Learning delivery of ABT-based educational content has the following advantages:

- It allows the control of training related costs, both in terms of travel expenses and in terms of time off-work. The latter includes the disruption to the work schedule pre and after training related travel, as well as the disruption to the lives of professionals as it usually takes a few days to get into the normal work rhythm
- The increased face-time and the limited use of self-paced learning in the context of a wider skill development strategy is a step forward from traditional distance teaching, which is not applicable in industrial processes and which suffers from a reputation of lower quality as compared to in-class instruction
- It allows training to take place intra- and inter-company, often across borders, in the context of a global economy

4. VISUAL COMMUNICATIONS TECHNOLOGY IN PROFESSIONAL SKILL DEVELOPMENT

4.1 Visual Learning and Media Rich Educational Content

Perceptual modality is a key consideration in learning design. It relates to the delivery method under which a learner best comprehends and absorbs knowledge. Individuals may learn more effectively through visual presentations, audio presentations, through reading texts in a self-paced manner, or combinations of the above.

In a manufacturing environment where training revolves around specific processes and tasks typically demonstrated by an expert in real-life conditions, visual presentations provide a vivid means for know-how transfer. Pictures, images and video help learners understand concepts and implementation steps better than oral explanations. Literature has not always succeeded in providing explicit or decisive conclusions with relation to the impact that multimedia technology has on learning. Until recently (Samaras, 2006) it failed to recognize a broader range of parameters like the knowledge level of the learner, the intrinsic cognitive load, support from the multimedia learning environment and cognitive processes encouraged of learners by the environment.

The theoretical and practical training must merge such factors, together with a production oriented process workflow approach where the pedagogical methods are closely connected to practical fabrication activities according to the production path of a predefined structure. The theoretical training must contain a mixture of text based learning resources, and video clips in streaming video format or DVD (Stav, 2006 a and b) demonstrating various types of practices within mechanical industry:

Laboratory type videos showing reproducing best practices in production process and/or provide solutions to problems arising during the execution of specific tasks

Equipment type videos demonstrating the proper operating of machinery and tools

Industrial examples demonstrating practical applications of specific processes and skills

Case oriented videos offering visual examples acting as introduction to the instruction of a topic or as practical confirmation of theoretical teaching

Action videos demonstrating behavior, i.e. how to do or not to do a working process

Video tours displaying overviews of working processes or construction of complex working machines that are put together by a large number of small components, each requiring a significant amount of knowledge and work

Conceptual videos mediating theoretical results such that professionals, suffering from dyslexia, don't need to obtain knowledge just by reading and understanding complex text based documents

The learning material may also contain online data like notes and PowerPoint presentations that have been tracked from Smartboard sessions. They may be uploaded into the Learning Management System immediately after a video training session. Practical training is held in laboratory or in the workshop, and may when needed be supported with video clips from the theoretical curriculum.

5. EFFECTIVE SOLUTIONS FOR KNOW-HOW TRANSFER

Training offered in combination with job and industrial production activities, is one of the best available training methods since it is planned, organized, and conducted at the employee's worksite. Such training will generally be the primary method used for broadening employee skills and increasing productivity. The combination of ABT, easy access to various classes of video resources (Stav 2007) and inclusion of blended learning methodologies validate a new generation of training and educational activities. It offers the teachers, as well as the students, figure 3, access to new training environments compared with what is frequently used today in SME.

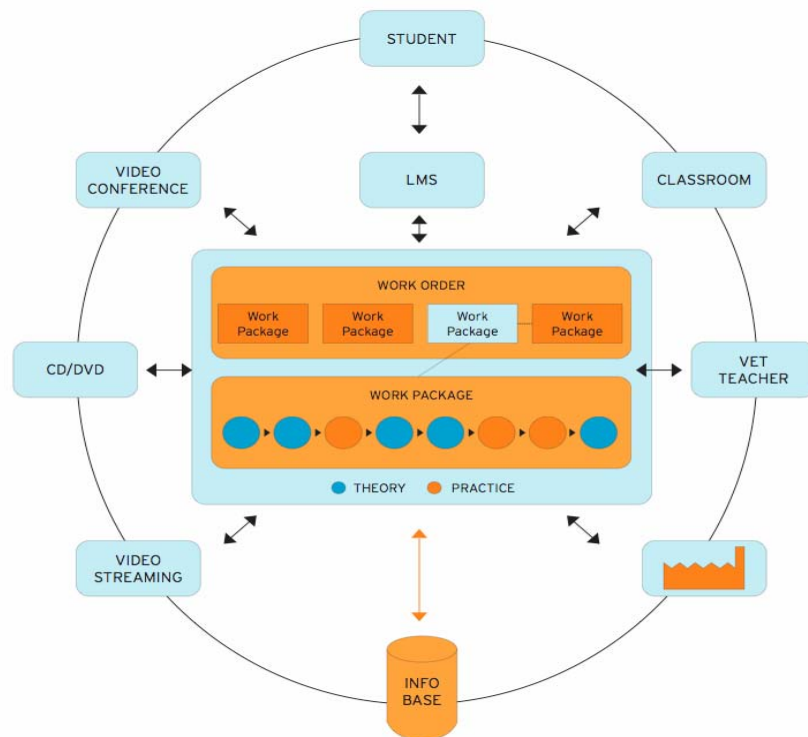


Figure 3. The Activity Based Training environment.

The Activity Based Training environment utilizes work orders and work packages, in combination with on-site training, Learning Management Systems (LMS), video streaming and videoconferencing. The info base offers on-line access to best practices and state of the art video communication.

The outsourcing process will usually involve transfer of various types of technical information and know-how to different user groups. Oral communication is fast, effective, and may leads to quick results without any risks for misunderstandings or misinterpretations since issues related to the semantic interoperability within technical communication may be addressed immediately during the ongoing discussion. Unfortunately, oral communication traditionally takes place face-to-face. Oral communication processes may be offered efficiently at distance by mixing state of the art high quality videoconferencing solutions with digital backboards. In such a setting two video streams are transferred in parallel, one containing the instructor and the second one the presentation the instructor make up on the digital blackboard.

The instructor may in real time, as shown in Figure 4, make up notes, remarks and annotations on the Smartboard, while he/she discuss details related to welding specifications and welding procedures with the personnel at the remote site (e.g. a company receiving an outsourced production). The instructor may watch the personnel at the remote site on one of his monitors during the verification of the production process knowledge. The personnel may at the same time look at the instructor and the notes he/she makes on the Smartboard on two screens. The staff may in real time ask questions and discuss practical issues related to the production process. Two monitors are used for small groups of personnel, while two large screens are used large group of staff.

This system solution may be used for easy; flexible, ongoing verbal and visual verification of mechanical industry production process knowledge that require detailed technical communication processes to wide user groups inside a company. This includes defining possible problem areas, verification of the existing and required competence levels, identification of possible competence gaps, continuous development of methods for corrective actions, etc.

6. CONCLUSIONS

This paper presented new Activity Based Training (ABT) methodologies for efficient know-how transfer in the context of global production processes that takes advantage of the latest technology advances in the area of networking and visual communications. The principles for ABT focus on delivering theoretical content when it is needed just in front of the practical training tasks, linking directly theory and practice in order to create relevance and motivate the student, triggering ultimately reflective cognition processes. Such knowledge transfer is particular important within global production environments where it is necessary to transfer mechanical industrial company specific know-how and competence across large distances, often on a just-in-time basis, due to tight production constraints.

The methodologies discussed in the paper are applicable both towards formal training and informal skill transfer and may act as complementary skill development processes to the formal VET training system. The selected pedagogical framework is closely connected to the production workflow through learning resources utilizing orders, each containing a number of work packages.

The methodologies are under validation in real-life conditions involving European companies across borders active in the welding sector as well as standards organizations including the European Welding Federation, the Institut za Varilstvo in Slovenia, and the Polish Centre of Welding Technology. However, they are adaptable and applicable in the wider manufacturing sector.

ACKNOWLEDGEMENT

The work presented in this paper is partially supported by European Community under the Leonardo da Vinci programme

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B2B E-MARKETPLACE MODEL FOR SUPPLY CHAIN MANAGEMENT USING ROSETTANET AND WEB SERVICE STANDARD: A CASE STUDY OF MOTORCYCLE PARTS INDUSTRY IN THAILAND

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ABSTRACT

Business competition in the globalized world, particularly the incoming of multinational companies in developing countries, has led to obligatory changes among small- and medium-sized industrial (SME) entrepreneurs in their trading strategies. Traditional business approach needs to be evolved by establishing the strengthened alliance network of entrepreneurs, and bring together advance technologies and appropriate communication. This research presents a B2B e-MarketPlace model for supply chain management suitable for SME entrepreneurs. The proposed model employs SOA technology to facilitate business processes interoperability without affect to the entrepreneurs' existing system. In order to provide efficient electronic data interchange among heterogeneous business processes, the B2B e-MarketPlace model employs the open standard like RosettaNet to set up the procedure and method of electronic data interchange. The greater benefits precipitated from this work will enable SME entrepreneurs to extend the scope of alliance network membership towards countries in the Me Khong river basin, as well as other countries in the world with no boundaries.

KEYWORDS

Interoperability, Supply Chain, B2B e-marketplace, SOA, Web service, RosettaNet.

1. INTRODUCTION

Many organizations rush to create B2B applications to efficiently trade goods and services electronically. Traditional business approaches have been evolved to e-business exchange, such as Electronic Data Interchange (EDI) which enables the structured transmission of data between organizations with agreed message standards without human intervention. However, EDI is highly dependent on the participation of trading partners and requires the EDI translation software to transform various types of trading partner documents into the standardized format of electronic documents, such as the Electronic Data Interchange for Administration, Commerce and Transport (*EDIFACT*)¹ and *ASC X12*² standards. Besides, the trading partners, the members of the EDI/VAN network, need to pay the service costs monthly according to the sizes of data sent and received, including a particular software cost. These are the barriers for small and medium size enterprises (SMEs) when getting start with the initial implementation of EDI system as mentioned in the survey of the ERP/Logistics Development for Hom Mali Rice using Global Standard in Thailand (Arch-int, S. et al., 2007) and the study of B2B e-market in China (Jing, Z. et al., 2008).

Currently, Internet infrastructure enables collaborative network development and provides seamless interoperability in a collaborative networked environment (Claudia-Melania, C. et al., 2008). The new trend of data interchange standard has being shifted from the UN/EDIFACT (Christian, H. et al., 2008) and X12 standards to new standards, such as *RosettaNet*³ (RosettaNet-b, 2002), Electronic Business Extensible

¹ www.unece.org/

² www.x12.org/

³ www.rosettanet.org/

Markup Language (*ebXML*)⁴ (OASIS, 2006), and Business Message Standards (*BMS*)⁵ (GS1, 2008) with increasing tendency for usage and acceptance. These new standards endeavor to define business documents on a basis of *XML*⁶ in which messages are exchanged between trading partners over the Internet.

With the greater benefits and growing acceptance of Web service (W3C, 2004), Web services are the software systems in distributed programming environment that are capable of opening the internal applications of an enterprise to the outside by establishing real time communications with other applications on the Web (Mostafa H., S., 2007). Web services render themselves attractive for supporting flexible collaborative relations within the enterprise as well as among different enterprises without the intervention of EDI service provider.

This research proposes the B2B e-MarketPlace model for Supply Chain Management (SCM) using RosettaNet and Web Service Standard which are applied to a case study of motorcycle parts industry which is one of the importance industries in Thailand. Since Thailand is one of the leaders of high quality manufacturers of the motorcycle parts in the world, there are a large number of parts manufacturers and motorcycle repair shops spread out around the country. However, the present problem confronted by entrepreneurs is the competition of rival companies from abroad that are expanding their standardized repair shops covering all areas in the country. This has an effect on motorcycle repair shops and relevant existing entrepreneurs at the SME levels.

In order to improve the traditional business model, this research proposing the new B2B marketplace model for SCM. SCM (Harland, 1996) is the management of a network of interconnected businesses involved in the ultimate provision of product and service packages required by end customers. SCM focuses on managing and coordinating the movement of materials and information out of the organization toward the end-consumer across supply chain that require appropriate mechanisms and tools to increase the efficiency and decrease operational costs, as well as support the standardization of B2B electronic exchanges.

The proposed B2B e-MarketPlace model employs existing B2B standards, such as RosettaNet to establish the standard business documents and the sequence in which business documents are exchanged automatically between trading partners over the Internet. In order to increase interoperability between different business applications, the proposed model employs Web services technology designed based on Service-Oriented Architecture (SOA) to unify business processes and make business processes accessible within enterprises and across enterprises.

In addition, the use of web services is flexible in terms of entrepreneurial networking in order to obtain business documents exchange and discover buyers and sellers from the open standard Universal Description, Discovery, and Integration (UDDI) (Saloner, G., and Spence, A., 2002). With the use of these technologies, the management of logistics and supply chain can be simplified improving productivity, reducing costs dramatically and providing quicker, more accurate service to the customer with higher satisfaction levels. In addition, business information integration both within a company and with a partner company will be more streamlined and even faster.

2. RELATED TECHNOLOGIES

2.1 RosettaNet

*RosettaNet*⁷ standard is a standard developed for the integration of business processes and the exchange of business documents among international enterprises. To align the processes used along the supply chain, the description of the business processes uses Partner Interface Processes (PIPs) to define the interaction standards for a broad set of supply chain scenarios, and dictionaries that provide the data standards and common product descriptions within the PIPs. The RosettaNet objectives are to facilitate the rapid development of PIPs and to facilitate the rapid development of e-business applications that execute RosettaNet-compliant PIPs. All RosettaNet messaging systems must comply with the RosettaNet

⁴ www.ebxml.org/

⁵ www.ebxml.org/

⁶ www.w3.org/XML/

⁷ www.rosettanet.org/

Implementation Framework (RNIF) standard (RosettaNet-a, 2002) that defines how integration systems will transport PIP messages.

In RNIF, a business process may consist of a number of continuing documents as shown in Table 1 that illustrates the process of documents exchange based on RNIF classified by business process types.

Table 1. Examples of documents exchange classified by different business process types

Forecast Sharing and Exceptions Scenario	Order to Invoice scenario	Inventory Visibility & Replenishment Scenario
PIP 4A1 Notify of Strategic Forecasting PIP 4A2 Notify of Embedded Release Forecast PIP 4A3 Notify of Threshold Release Forecast PIP 4A4 Notify of Planning Release Forecast PIP 4A5 Notify of Forecast Reply PIP 4A6 Notify of Forecast Exceptions	PIP3A4 Request Purchase Order PIP3A7 Notify of Purchase Order Update PIP3A8 Request Purchase Order Change PIP3A9 Request Purchase Order Cancellation PIP3B2 Notify of Advance Shipment PIP3C3 Notify of Invoice	PIP 3B2 Notify of Advance Shipment PIP 4B2 Notify of Shipment Receipt PIP 4B3 Notify of Consumption PIP 4D1 Notify of Material Release PIP 4C1 Distribute Inventory Report PIP 3C3 Notify of Invoice

2.2 E-MarketPlace

The centralized supply chain systems (CSCS) is a system that combines all functions at one point so as to obtain efficiency and complete-cycle centralized servicing management, for example, integrating haulage and warehouse together. Information technology is introduced into management, especially the management of trading in the industrial supply chain for SME industries. In this respect, the service provider will act as the fourth party logistics provider coordinating and providing information services for operation in the supply chain such as selection of purchasing orders before dispatching to appropriate manufacturers or dealers (Xiuhui, L. and Qinan, W., 2007).

B2B supply chain is a means for exchanging business data without any middleman or EDI service provider. It is suitable for SME entrepreneurs as it relies on e-MarketPlace (Brussels, 2007), a CSCS centralized approach that permits an electronic market maker's to be a centralized market or a medium linking the buyer and the seller, including the 3rd party logistics. Service users will have to apply to be a member, a network, or an entrepreneurial group. They will be able to exchange trade data/services or to trade goods between each other. These goods may be common and can be bought by anyone (Horizontal e-MarketPlace), or they may be specialized merchandise for a specific group of buyers only (Vertical e-MarketPlace). Trading processes include many methods, such as standard price offering, auction, or request for quote (IBM-a, 2007, IBM-b, 2007).

B2B e-MarketPlace does not only involve basic operational components, for example, merchandise management (such as systematize goods, cataloguing goods), coordinating and cooperating (such as trading management and payment) and safety management, but also requires management processes for business documents so as to perform business document exchange between trade partners (Umar, A., 2007). Such a system is extremely suitable for SME entrepreneurs, for its costs of development and installation of information technology system are low when compared with a self-developed system.

3. SYSTEM DESIGN

3.1 The Motorcycle Part Supply Chain

In traditional trading process, there are three major entrepreneur groups involved in the process of selling and buying the motorcycle parts, namely, the upstream group or the manufacturers of motorcycle parts, the middle stream group or retail shops or wholesalers of parts, and the downstream group or motorcycle repair shops (see Figure 1). The Figure 1 illustrates the relationships among stakeholders of the traditional trading of motorcycle parts.

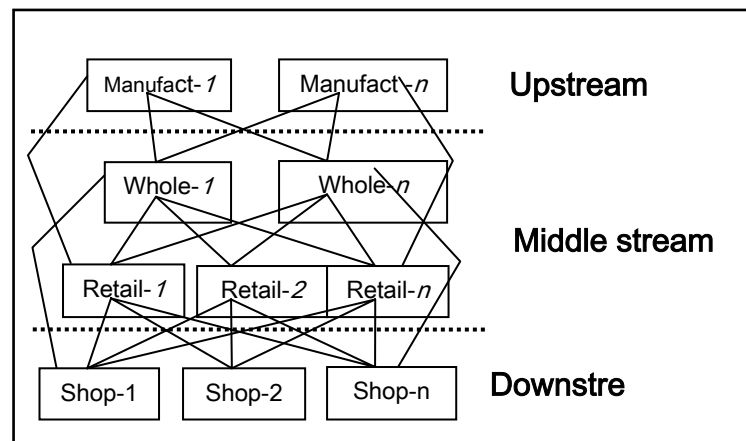


Figure 1. Management of Logistics and Supply Chain of Traditional Motorcycle Parts Industry

Figure 1 depicts a simplified supply chain of motorcycle parts. It can be seen that suppliers independently sell the parts to consumers. For example, Manufacturer 1 (*Manufact-1*) can sell his parts to Wholesaler 1 (*Whole-1*) or Wholesaler 2 (*Whole-2*), or even Retailer 1 (*Retail-1*). Conversely, *Retail-1* can order motorcycle parts from any wholesaler, and can even order them directly from the manufacturer. This occurs when there are no strength relationships among these entrepreneur groups in the supply chain.

With the loose of entrepreneurial network, the heterogeneity of trading channels does not allow for powerful business alliance networks. Moreover, orders from consumers downstream are not stable, since there are no regular consumers. As a result, entrepreneurs have difficulty in predicting their sell or stocks, leading to high costs and instability. Finally, they are not able to compete with larger entrepreneurs.

Based on the collaborative networks paradigm (Claudia-Melania, C. et al., 2008), building a business alliance network is a means for managing logistics and supply chain in the SME motorcycle part industry. The alliance network is an alternative solution for the above mentioned problem that enables SME entrepreneurs to compete in the market. According to the collaborative network model, interoperability represents the capability of two or more systems or components to exchange information.

The research proposed a new model for supply chain management as shown in Figure 2. For this model, the repair shop entrepreneurs are members of only one retailer. Similarly, a retailer is a member of only one wholesaler. Entrepreneurs that are situated in proximity, the same district or province will be grouped together in order to reduce costs of transportation of motorcycle parts from the original point to the end point. The supply chain management system has the following major characteristics:

- B2B between the supplier and the consumer in the supply chain is achieved via e-MarketPlace in which members in the motorcycle part supply chain network have to apply for a membership in e-MarketPlace.
- The order of motorcycle parts is made from members in the network downstream, step by step, to the network upstream. For example, a repair shop will order a part from a member retailer. The retail shop in turn orders the part from a member wholesaler. The buyer is able to specify the supplier or record the order list and goods specification together with required prices to the system and forward to the supplier to consider before proceeding with trading and shipping of the goods.
- There is a coordinator who responsible for providing services including orders from retailers to manufacturers. Since B2B e-MarketPlace provides a virtual inventory of all manufacturers, each coordinator is able to efficiently manage the order and ship the goods just in time (JIT). The management of stock of the wholesalers and retailers as well as reduction of stock size and ordering process of motorcycle parts will thus be made efficient.
- When the buyer and the seller are matched, the process of data exchange in electronic business is accomplished. The supplier can ship the goods directly to the consumer without going through the coordinator.

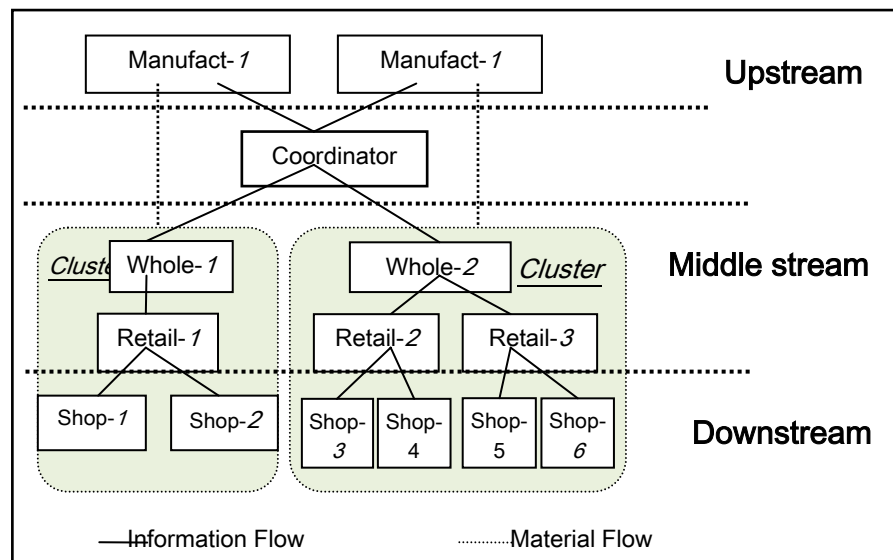


Figure 2. The New Model for Management of Logistics and Supply Chain of Motorcycle Part Industry

3.2 Architecture of B2B e-MarketPlace

In this section, the proposed architecture of B2B e-MarketPlace for supply chain management is depicted in Figure 3. The main components of the architecture consist of two components, namely, information management system, and transaction management system, as described below:

1. Information Management System is responsible for managing information provided for entrepreneurs at the clients (sellers and buyers), such as the public relation (e-Advertising), the education information (e-Education), and so on. The clients are able to access such information or post their opinions or questions to the system.

2. Transaction Management System is responsible for (1) receiving and sending inventory data of the entrepreneurs at the clients and updating the central stock at the e-MarketPlace so that the inventory data of central stock is always in line with the stock at the clients, and (2) receiving and sending e-business documents between entrepreneurs based on the RosettaNet standard with the use of web service as a tool for accessing the entrepreneurs' data.

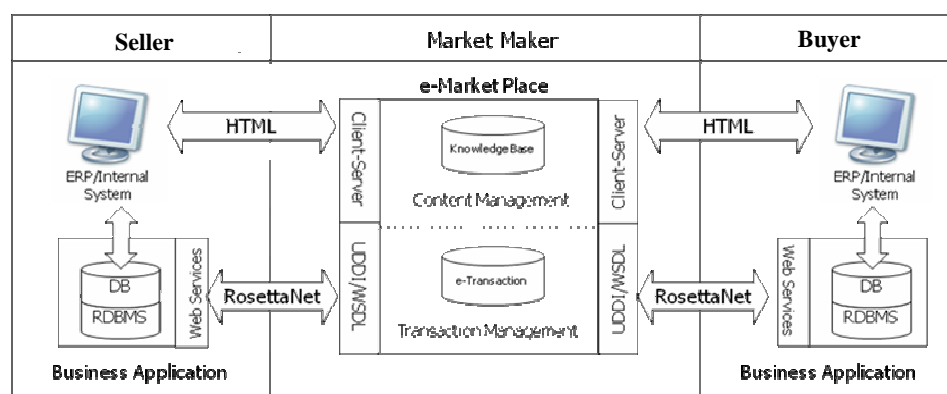


Figure 3. Architecture of B2B e-Marketplace

The proposed B2B e-MarketPlace architecture has been designed on the basis of SOA in order to enable the dynamic interoperability between the heterogeneous business applications and integrate business

documents sending from various entrepreneurs. The architecture employs RosettaNet to form the standard business documents to be exchanged among entrepreneurs.

The system designed according to the architecture enables entrepreneurs to apply easily to become a member of the B2B network. The interoperability of entrepreneur business applications will not affect the Enterprise Resource Planning (ERP) of each entrepreneur. In other words, the ERP of each organization in the supply chain still maintains its privacy.

4. IMPLEMENTATION

4.1 Case Study

The system used in the case study for supply chain management is the *SME007 Plus*, or in short, the *MoPro* (Motorcycle Professional). This system is designed to be the network of the SME motorcycle part entrepreneurs in Thailand that completely covers the upstream level (the motorcycle part manufacturers) to the downstream level (the motorcycle repair shops) scattered around the country.

4.2 System Implementation

The SOA-based B2B e-MarketPlace architecture composes of two parts, the web service clients and the web service providers, as shown in Figure 4.

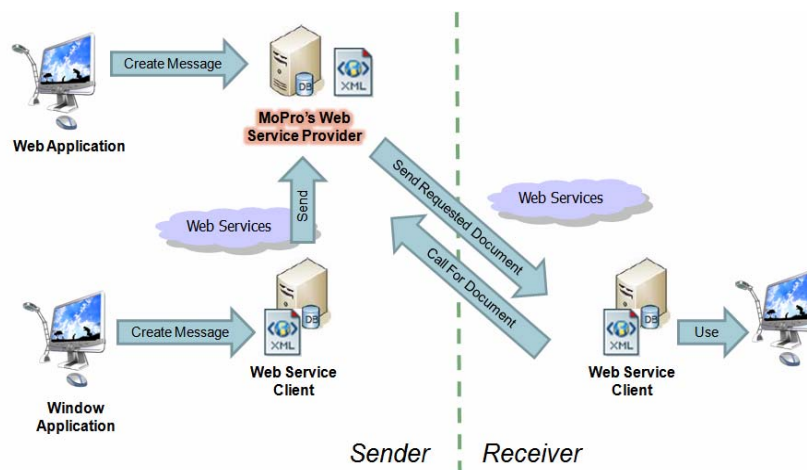


Figure 4. SOA-based B2B e-MarketPlace Architecture

1) Web Service Clients consist of the buyer and seller who are members of the B2B e-MarketPlace and serve as web service requestors. The web service clients possess their ERP systems (internal systems) which can be constructed with different business application languages together with the proprietary databases. These ERP systems can communicate and exchange data with each other via the web service provider with the help of web services technology. Meanwhile, the web service client can also interact with their ERP systems for retrieving and updating data.

2) Mopro's Web Service Provider functions as a *RosettaNet* server which obtains the user requests from web service clients and subsequently invokes the corresponding services to serve the user requests. Mopro's Web Service Provider is developed conforming to the web services standard of *RosettaNet MMS Web Services Profile R11.00.00A* (RosettaNet-b, 2007) that can be applied to the motorcycle parts businesses. The Mopro's Web Service Provider is implemented with PHP NuSOAP and operated under Apache Tomcat Web Server version 6.0.

The advantages of the proposed architecture can be summarized as follows:

1. The client systems (ERP systems) do not need a fixed identification number for the Server (Fixed IP Address) to exchange data via e-MarketPlace.

2. In case of a dispute in e-Commerce documents between the sender and the receiver, there will be an investigating medium for tracing and tracking the real trading occurrences. Additionally, safety of the exchange process can also be incorporated.

4.3 E-Business Document and RosettaNet

The processes of selling and buying of motorcycle parts through the B2B e-MarketPlace system facilitate the suppliers to record the goods data, and prices and enable the buyers to verify their required item lists. Therefore, this electronic business process does not require a procedure of product catalogue request or a quote request (PIP3A1). The sequence diagram is shown in Figure 5.

The Order to Invoice Scenario consists of four documents, namely:

1. *Purchase Order Request* (PIP3A4 Purchase Order Request) is a document that provides details of the required goods under the condition agreed by the buyer and the seller.

2. *Purchase Order Confirmation* (PIP3A4 Purchase Order Confirmation) is the confirmation of the purchasing order. There are three options: accept, reject or pending.

3. *Notification of Shipment Received* (PIP4B2) is a document used when the buyer has received the goods and notifies the seller.

4. *Invoice* (PIP3C3) is the invoice document sent by the seller to the buyer (immediately after shipping) so that the buyer will be prepared to pay.

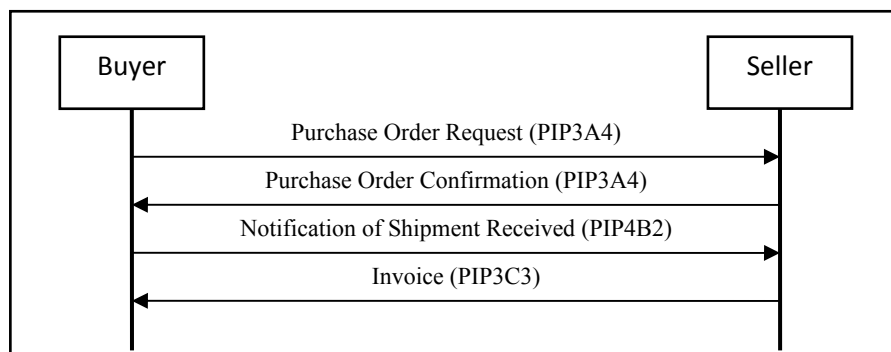


Figure 5. Order to Invoice Sequence Diagram

5. CONCLUSION

Severe competition in Thailand's motorcycle part industry results in evolution of supply chain model which is deviated from traditional approach that does not have a strong alliance network to B2B e-MarketPlace model which is suitable for SME entrepreneurs.

MoPro business process can be applied to the case study of motorcycle part industry in Thailand. The results of the experiment in the case study reveal that the B2B e-MarketPlace model can be used efficiently as a means to build the commercial alliance network of entrepreneurs in the supply chain. The entrepreneurs will be able to receive information and regular exchange of knowledge with each other. Most importantly, the management of ordering processes and stock information will be accomplished efficiently all through the supply chain.

With the salient characteristics of open standards such as SOA and RosettaNet, system development based on these standards provides greater benefits. For instance, we combine SOA technology in B2B e-MarketPlace model to facilitate business processes interoperability without affect to the entrepreneurs' existing system. With an adjustment of the interface between the ERP system and B2B e-MarketPlace, the ERP and B2B e-MarketPlace systems can be interoperability. It is a flexible system that can be simply expanded. Besides, using open standard like RosettaNet to set up the procedure and method of electronic data

interchange enables SME entrepreneurs to extend the scope of alliance network membership towards countries in the Me Khong river basin, as well as other countries in the world with no boundaries.

However, although internationally standardized B2B e-MarketPlace has no limitation in terms of technique, business process still involves details required to be agreed by entrepreneurs before e-Commerce can take place. The researchers hope that the proposed B2B e-MarketPlace for motorcycle part industry will be a good and appropriate framework for other industries as well.

ACKNOWLEDGMENT

This research was supported by a grant from The Office of Software Industry Promotion Agency (Public Organization) (SIPA), Ministry of Information and Communication Technology (MICT) of Thailand and the National Electronics and Computer Technology Center (NECTEC) of Thailand.

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SAFE SYSTEM: SECURE APPLICATIONS FOR FINANCIAL ENVIRONMENTS USING MOBILE PHONES

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ABSTRACT

Mobile financial transactions are used by more and more people due to a widespread proliferation of mobile phones and wireless technologies. One of the most important concerns with such transactions is their security. The reasons are based on weaknesses of wireless protocols and handling of financial data. These aspects make mobile financial applications even more vulnerable to fraud and illegal use than similar transactions performed over fixed networks. Therefore, one of the main prerequisites for successful, large-scale and broad deployment of mobile financial applications is their security. This paper introduces the concept of SAFE system (Secure Applications for Financial Environment) that represents a secure, convenient and reliable infrastructure for mobile financial transactions. The infrastructure comprises Mobile Wallet, three servers: Gateway, IDMS and Bank servers, security protocols, and messages between all components.

KEYWORDS

SAFE, mobile transactions, security, wireless protocols, security infrastructure, mobile phone

1. INTRODUCTION

Mobile banking (m-banking) is based on the use of mobile phones or other mobile devices to perform various financial transactions, either directly with the recipient or indirectly, via a client's bank account. m-banking is one of the newest approaches to the provision of financial services through wireless Internet network, made possible by the widespread adoption of mobile phones especially in developing countries. The rollout and functional capabilities of mobile telephony have been rapid and have extended usage well beyond classical mobile applications (telephone calls and short messaging). There is mounting evidence of positive financial, economic and social impact of those technologies all over the world.

One of the most important issues with mobile transactions is their security. Currently several mainly SIM chip vendors and banks, offer initial version of such applications for banking transactions either without security or based only on user PINs. These methods not only do not provide satisfactory level of security required for financial transactions, but create false impression of their security, thus opening possibilities for hackers to explore their vulnerabilities. When mobile financial transactions are performed internationally on a large scale without adequate security, it is certain that current financial losses due to on-line fraud will be much larger.

SAFE (Secure Applications for Financial Environment) is the system that performs various financial transactions using mobile phones and other mobile hand-held devices. Current initial versions of similar systems provide simple client-to-bank transactions [1-3]. SAFE system supports transactions with multiple banks, direct client-to-merchant payments, person-to-person transactions, and other, non-banking mobile applications. In addition, the distinguished feature of the system is its strong security for users, their transactions and applications.

2. APPLICATIONS AND PARTICIPANTS

SAFE system is designed to support broad range of secure financial transactions, which may be classified in three groups:

Financial transactions performed by individuals:

- Deposits and withdrawals of cash using client's own account with "digital" ATMs,
- Deposits and withdrawals using client's own account based on the concept of "Mobile ATM" in developing countries [4],
- Deposits and withdrawals of digital cash using client's own account with "digital" ATMs,
- Transfer funds between user's own accounts in the same or in different banks,
- The ability for third parties to make deposits into a user's account (employer, family member, merchants, loan provider or a micro-finance organization in developing countries),
- The ability to make retail purchases with m-Commerce enabled merchants using debit and credit card payments,
- The ability to make retail purchases with m-Commerce enabled merchants using micropayments,
- Provision for bill payments.

The second group is corporate financial transactions:

- Corporate-to-bank transactions (m-Banking),
- Corporate-to-Corporate transactions (quotes, purchase orders [5], invoices, payments, etc.),
- Corporate-to-individual transactions (payments, fees, various reimbursements etc.).

The third group is non-monetary transactions:

- Collecting and using bonus points,
- Collecting and using loyalty points,
- Using prepaid authorizations (gift cards, telephone air-time, etc.),
- Handling prepaid or purchased tickets.

The participants in those transactions are the following:

Banks – perform registration and certification of individuals and provision of financial services,

Bank agents – individuals who provide financial services on behalf of banks, locally at the banks' locations or remotely as banks' agents,

Financial Services Providers – institutions providing financial services, like post offices, Western Union, currency exchange providers, etc,

Security Services Providers – institutions providing security services in large, international networks, like identity (registration) services, certification services, smart cards services, etc,

Merchants – companies selling goods and services and charging for those goods and services,

Clients – individuals initiating or receiving transfers as the result of financial transactions.

3. SYSTEM COMPONENTS AND ARCHITECTURE

SAFE system is organized in the form of a large-scale, federated security architecture. The components of that architecture are various types of servers and (static or mobile) workstations.

There are five types of servers in the SAFE system:

Identity Provider (Registration) Servers – providing registration services and distribution of reliable identities,

Certification Servers – providing certification of participants, issuance of their X.509 certificates, management and distribution of those certificates,

SAFE Gateway Servers – specialized servers that support various secure financial transactions, used as the "front-end" (proxies) to Bank Servers,

Bank Servers – interface servers in banks performing linking of the system to standard banking applications and transactions,

Merchant Servers – servers located at merchants' premises performing direct financial transactions with clients.

The following stations are used in the SAFE system:

Client Mobile Stations – those are mobile phones loaded with secure applications,
Client Static Stations – those are standard PCs used by clients to perform financial transactions from static locations (home, offices, etc.),
Agents Mobile Stations – these stations are either smart phones or hand-held devices with smart card capabilities, used by mobile banks' agents,
Registration Stations – those stations are standard PCs enhanced with smart card capabilities and used by registration agents,
Financial Services Provider Stations – those stations are also PCs with smart card and used by financial services providers,
Merchants Stations – those are POS terminals, which are enhanced with smart card capabilities and used by merchants to perform direct financial transactions with clients.

System components and the architecture are shown in the following Figure:

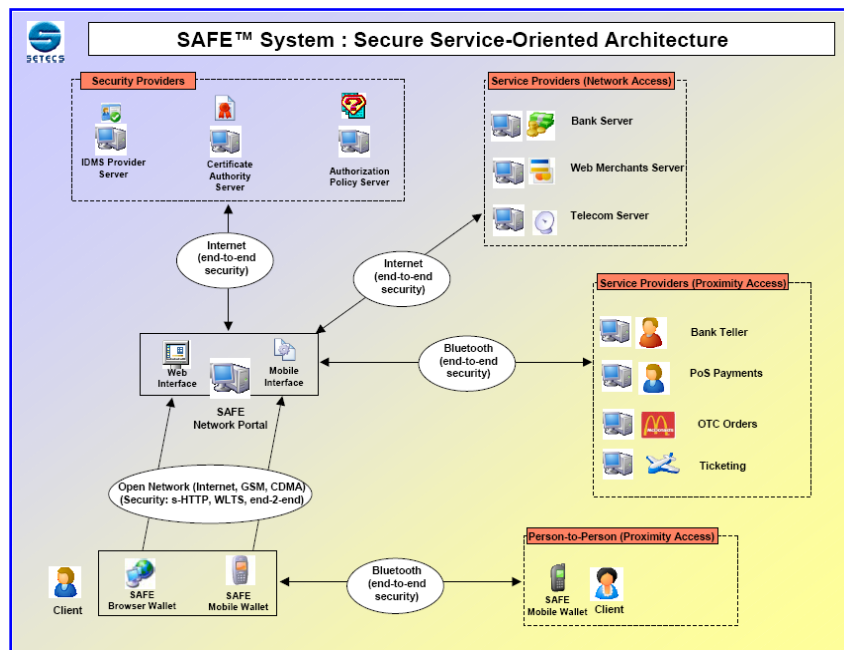


Figure 1. Components and the Architecture of the SAFE System

All servers are running on standard OS platforms – various versions of Windows, using Java Run-Time Environment, SQL-compliant database servers and TCP/IP protocols. Deployment of Client Mobile Stations, especially Secure Mobile Wallet, deserves additional attention and considerations. Namely, the development goal was that the Wallet should be applicable on different types of mobile phones and in different environments (developed and developing countries). Taking those limitations into account, there are several versions of the Mobile Wallet. The simplest version is based on SMS messages, sent over to the Network Portal, without the need of preloading of any software. The next version is “thin” Wallet, software that provides only GUI for SMS messages. The most comprehensive version is “thick” Wallet – fully functional software that must be pre-loaded into a phone. The full Wallet provides all security features described in this paper. If the Wallet is loaded into the phone, then there are two versions of the Wallet: one that can be downloaded through mobile Internet and the other that is pre-loaded in the SIM chip. Thus, SAFE Wallet supports a variety of mobile phones, with alternative capabilities, and wireless communication protocols.

4. USAGE AND SYSTEM OPERATIONS

4.1 Registration of Participants

As the first step all participants in the SAFE system are registered. Registration is performed by Registration Agents. Registration data are stored in the Registration database of the IDMS server (see Figure 1). This step may be performed by the bank, by telecom operator or by any other independent ID services provider. Thus all participants in the system have reliable and verifiable registrations data used for all SAFE transactions.

Registration is performed as the face-to-face procedure, where personal data and credentials are verified before being entered in the system. Registration Agents fill out registration form and data are stored in the Registration database at the IDMS Server. At the same time registration data is transferred on-line into mobile phones of customers and bank agents and also transferred to other parties for later use.

4.2 Certificates and Smart Cards

In the SAFE system all participants have X.509 certificates. They are issued by the Certification Authority (CA) Server, based on registration data stored in the IDMS Server. In addition, all agents who perform security management or high-value transactions are issued smart cards. Customers do not use their own smart cards, due to the high cost of mobile phones that support smart cards. For customers, key pairs are generated in their mobile phones, while for those in possession of smart cards, key pairs are generated by their cards.

Certificates and smart cards are issued by banks and by all Service Providers.

Certificates, issued by the CA server, are stored in mobile phones and in smart cards. Therefore, security of all transactions is based on public key cryptography, supported either by software in mobile phones or by smart cards.

After reliable and verifiable registration, certification and issuance of smart cards, an instance of the SAFE system is ready for its secure operation, supporting various secure financial applications.

4.3 Cash Dispensing: Mobile and Static ATM

Mobile and static ATM are two innovative approaches for dispensing of cash, especially suitable in regions where there are no standard banking ATMs. With “Mobile ATM”, cash is distributed by the specialized bank agents, who visit areas without standard ATMs. They dispense cash to customers upon receipt of the authorization messages from banks based on customer cash requests. The procedure is equivalent with static ATMs, where cash is dispensed by post offices, eventually merchants, and other cash distribution agencies.

The sequence of steps and exchange of messages for this function are the following: Customer who needs cash comes to the location of the Mobile (Bank Agent) or Static ATM. Using his/her phone, the customer sends Cash_Request message to the specialized SAFE Server. The Server has direct connection into the banking network and verifies the status of the customer’s account. If the confirmation is received from the bank, SAFE Server sends Cash_Confirmation message to the Bank Agent or corresponding cash dispensing agent (like Post Office). When the message is received, cash is given to the customer.

4.4 Stored Money and Micropayment Transactions

Instead of cash, SAFE system can also distribute “digital cash” which is stored in mobile phone and later used for micro-payments. The prerequisite for this application is that merchants’ Point-of-Sale (POS) terminal is equipped with hardware and software supporting appropriate proximity protocol and micro-payment application. If so, customers do not need cash, therefore bank agents or cash dispensers described in the previous section. The sequence of steps and transactions is the following: Customer sends Cash_Request to the SAFE server. After validation as before, “digital cash” is debited from customer’s account, transferred to and stored in his/her mobile phone. Thus, mobile phone becomes “digital wallet”. When the customer comes to the POS, he/she approves payment transaction using mobile phone. The

payment amount is reduced from the customer's "digital wallet" and transferred to the merchant's POS terminal. It sends *Cash_Reclaim* message to the SAFE server which contacts merchant's bank server to make deposit into the merchant's account.

4.5 Debit and Credit Card Payments

These are standard debit and credit card payments, which today are performed using plastic debit/credit cards. In the SAFE system, magnetic stripe data (credit card number and other data) are stored in the mobile phone. Merchant's POS terminal must be capable to accept such data through proximity protocol. All other steps with this application are the same as in today's debit and credit card transactions. Debit/credit card data are entered into the customer's mobile phone either during registration or during the process equivalent to debit/credit card issuance.

The process is the following: customer uses his/her mobile phone to provide card number and other data to the merchant's POS terminal through the proximity protocol. Merchant either connects to the SAFE server to verify the authorization of the transaction or connects directly to the existing Card Payment Gateway. When the authorization is received, the payment transaction is completed. Later, merchant sends *Credit_Request* message to the SAFE server or Payment Gateway to request payment.

4.6 Account-to-Account Transactions

These transactions are performed between two personal accounts or between a personal and a corporate account. In both cases one customer is the sender (initiator of the transactions) and the other customer is the recipient. These types of transactions are suitable for remittance, personal payments, bill payments, etc. They are performed between two customers with accounts in the same bank or with accounts in different banks.

If the two customers have accounts in the same bank, then the sender initiates the transfer of money from his/her account to the account of the recipient. *Transfer_Request* message is sent from the sender's mobile phone to the SAFE server, which, after verification and effective transfer performed by the bank, informs the recipient about the transfer.

If recipient's account is in another bank, then after receiving authorization for the transfer from the sender's bank, sender's SAFE server will inform recipient's SAFE server about the transfer. Recipient's SAFE server will notify recipient's bank and the recipient.

4.7 Loans: Applications and Administration

SAFE system also supports various transactions for administration of loans. Those could be mortgages, home equity loans, or micro-loans in developing countries. Applicants apply for the loan and after approval loan provider transfers the amount to the applicant's account using account-to-account transactions, described in the previous section.

Applicants may also administer their loans, reviewing the status of the loan, payment schedule, initiating payments, etc. For this application, the messages are the following: applicant applies for the loan. Applicant's SAFE server will pass the application to the SAFE Server of the loan provider. When approved, applicant's SAFE server and bank server will be notified and the loan will be activated. Finally, the applicant may also use various transactions with its SAFE server to administer the loan.

5. SECURITY PROPERTIES OF THE SAFE SYSTEM

One of the distinguished features of the SAFE system, which makes it different from any other similar system, is its strong security. All participants in the SAFE system are registered through face-to-face procedure, so that all identities are strongly verified. Identification information stored in IDMS servers is encrypted, thus not vulnerable to the identity theft attack.

All participants in the system have personal security credentials: key pairs, certificates and other security tokens. For customers, they are safely stored in their mobile phones, encrypted and accessible only after

personal authentication. Participants in the system who perform sensitive and high-value transactions have cryptographic smart cards, which store their personal data and security credentials and perform all cryptographic operations. Each participant is authenticated before performing any transaction.

Using those cryptographic credentials, all SAFE transactions are strongly protected with end-to-end security protocol. All transactions are digitally signed, encrypted and enveloped for the targeted recipient. The system supports authorization based on identities and roles, thus all applications can be accessed and used only by authorized individuals.

Finally, identification, financial and authorization data are stored in databases in the encrypted form. Therefore, they cannot be illegally accessed by hackers or other unauthorized individuals.

The system keeps encrypted logs of all its operations, so all transactions can be undeniably traced to their originators. Thus, the system provides non-repudiation of its transactions and data.

In the current version, security of the system is justified based on application of advanced security technologies, while in the near future system security will be tested through practical deployments in several countries.

6. CONCLUSIONS

SAFE system provides comprehensive protection for transactions in wireless environment, which includes not only strong authentication of every registered entity, but also confidentiality, integrity and availability of all sensitive data. Using extensibility of SAFE Gateway Servers and their federation, the system can scale smoothly to global, international environments. Once an instance of the system is established, additional service providers (banks, merchants, etc.) may be easily added simply by registering them with the SAFE Gateway Server [6]. For international transactions, between two countries or between two instances of the SAFE system, scaling is provided by federating two or more SAFE Gateway Servers [7].

The system is compatible with all existing security features for Web transactions: SSL, SAML, secure XML, FIPS201 (PIV) smart cards and currently deployed proprietary banking security systems. With all those strong security features and advanced security technologies, SAFE system may be used not only for the financial transactions described in this paper, but also as security extension for any on-line banking system, based on Web technologies and services. Using SAFE system security features would greatly reduce identity theft and financial losses in banking and financial transactions.

ACKNOWLEDGEMENT

This research is sponsored by the “Mobile ATM” project supported by SPIDER (www.spidercentre.org) and by the “Models of transnational e-finance services” project supported by Vinnova.

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ASSESSING THE QUALITY OF AN ON-LINE SUPERMARKET

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ABSTRACT

Nowadays that competition for online consumers intensifies, service quality has become a key differentiator for online vendors and thus it has become increasingly important to have an appropriate means by which to measure it. One of the latest is E-S-QUAL. Nevertheless, whereas the topic has had risen certain interests in academic fields, the managers of companies with Web presence are not yet using it. Actually, some academic articles have appeared in the last five years. Particularly, some authors have been arguing about the construction of a scale to assess the electronic service quality provided by a website, but few companies are taking advantage of these new tools to assess its service quality. This article finds out that the generic E-S-QUAL scale fits quite well when is applied to an online supermarket. Finally, there are some practical conclusions for practitioners.

KEYWORDS

Internet; electronic commerce; electronic service quality; E-S-QUAL.

1. INTRODUCTION

The concept of quality has been studied for many years. The first contributions came from the manufacturing industry (Garvin, 1988; Deming, 1982; James, 1996). In the last two decades of the past century, some authors focused in the service sector. One of the most prestigious and recognized contribution was the SERVQUAL model (Parasuraman *et al.* 1985; 1988 and 1991). It is a generic instrument to measure the quality provided by a service. Later, these authors developed a new instrument -E-S-QUAL- devoted specifically to assess quality in e-commerce, (Parasuraman *et al.*, 2005). This is quite recent, nevertheless it has arisen a deep debate about its efficacy. The objective of this paper is studying if the E-S-QUAL applies when assessing the quality in an online supermarket.

A secondary objective is analyzing at what extent the dimensions of the Website quality impact on loyalty. It is also wanted to know the behavior of each quality factor towards some attributes as age, sex or study attaining level.

2. MEASURING QUALITY IN E-COMMERCE: E-S-QUAL MODEL.

There are two main streams of research in website quality. The first one relates to online retailing services in general, meanwhile the second stream focuses in the website design quality. Actually, both aspects are important and there can be found some links between them. It has been studied by some researchers. It is interesting to look at and Li and Suomi (2007). Both works have a good “state of the art” in this moment about the e-commerce assessing. Previously, Barnes (2006) made a good description of the worldwide e-commerce situation, taking the main conclusions from a group of specialists. There is a general agreement pointing out that Barnes and Vidgen (2002) were pioneers assessing the quality of a website, as well as Loiacono *et al.* (2000; 2007). Both developed their own scale separately. There are other significant contributions in this first steps in this research area. Yoo and Donthu (2001) developed the SITEQUAL scale. Van Riel *et al.*, (2001) also found out three dimensions in order to evaluate the overall satisfaction and intentions to continue using the site in the future.

In the last years, there has emerged some consensus about the rigor and explanatory capacity of the E-S-QUAL scale, developed by Parasuraman *et al.* (2005). It has been used in few different fields, although with different agreement accuracy level. It has to be pointed out that we found few applications. These applications emerged mainly from the academic interest, but the instrument has not been still disseminated in the online sellers. It was designed to measuring the service quality delivered by Web sites. From the academics, some authors have some concerns about it. Boshoff (2007) states that a six-factor configuration explains better the service quality than the original four-factor’s model of Parasuraman *et al.* The instrument is quite recent, and there is expected to generate a debate, in the academic field and in the e-business world as well. In spite of some criticism, most of the authors find the E-S-QUAL model useful in different situations (Connolly, 2007).

In short, the E-S-QUAL model provides a scale composed by four factors (see appendix) for measuring the service quality delivered by a website on which customers shop online. It is a battery of 22 items in a Likert scale from 1 to 5. The four dimensions are:

Efficiency: The easy and speed of accessing the site.

System Availability: The correct technical functioning of the site.

Fulfillment: The extent to which the site’s promises about order delivery and item availability are fulfilled.

Privacy: The degree to which the site is safe and protects customer information.

3. METHODOLOGY

We adapted the E-S-QUAL instrument to our case. Only two slight modifications were done. The questionnaire was filled up by the customers of the online supermarket using a specific web designed at this purpose. The population was quite low, so we encourage to the whole population to answer the questionnaire, giving a good reward to the respondents. Thus, the answer rate was quite high (table1).

Table 1. Technical record.

Total population	413 customers
Sample	164 valid responses with a margin of error of $\pm 5.95\%$ and a confidence level of 95.5% ($k = 2$ and $p = q = 50\%$)
Procedure	Simple random sample
Period of Study	December, 2007
Method used to collect information	Survey answered in a Web site especially designed on this purpose

The nature of the sample is shown in table 2. A gender bias is detected, and almost half of the respondents are between 35 and 44 years old. The attainment study level of the sample is high; more than half of the sample has a university degree. This kind of bias was also detected in the Parasuraman *et al.* (2005) study and in Boshoff (2007). It is interesting as well to note that more than three quarters buys once a month or with higher frequency. Also three quarters is being e-customer for longer than one year.

Table 2. Demographic characteristics of the respondent group.

Age category		
	Number	%
< 15	1	.6
15 - 24	2	1.2
25 - 34	44	26.8
35 - 44	73	44.5
45 - 54	34	20.7
55 - 64	7	4.3
65 - 74	1	.6
> 75	2	1.2
Total	164	100.0
Gender		
	Number	%
Man	38	23.2
Woman	126	76.8
Total	164	100.0
Education level		
	Number	%
Without studies	5	3.0
Primary school	11	6.7
Secondary School	52	31.7
University degree	91	55.5
Others	5	3.0
Total	164	100.0

The first phase of the data analysis procedure was to conduct an array of exploratory factor analysis to assess how many dimensions were detected in the electronic service quality. Next we proceed to a reliability study of the factors proposed. Finally, some confirmatory factor analysis was performed to assess the validity of the scale.

4. EMPIRICAL RESULTS

4.1 Exploratory Factor Analysis

The first step was to conduct an exploratory factor analysis, using the main components method, with a varimax rotation and taking those factors with Eigen value greater than one. The Kaiser-Meyer-Olkin of the sample was 0.860. Also the sphericity test of Bartlett foresees a satisfactory analysis. Five factors were detected, capturing the 69.05% of the variance (table 3).

At the first glance at table 3, it appears a great resemblance with the original E-S-QUAL. The first factor –efficiency– is almost equal to the original, with the exception that EFF5 loads on the second factor. Actually, an attentive reading of the item clarifies the reason of this migration. Yes indeed, “It loads its pages fast” appears to be closer to “System availability” than to “Efficiency”.

Table 3. Rotated factors using the complete battery of items.

	Component				
	1	2	3	4	5
EFF4	.837				
EFF8	.673		.400		
EFF2	.662	.382			
EFF3	.654	.425			
EFF7	.566	.436	.405		
EFF1	.545		.436		
EFF6	.543	.353			
SYA3		.861			
SYA2		.837			
EFF5		.754			
SYA4		.681	.475		
SYA1	.498	.509			
FUL1			.756		
FUL5			.746		
FUL4			.729		
PRI3				.898	
PRI2				.883	
PRI1				.855	
FUL2					.779
FUL7		.405			.722
FUL6	.505				.587
Eigen-value	7.789	2.172	2.015	1.373	1.150

Method of extraction: Analysis of main components.

Method of rotation: Varimax normalization with Kaiser.

The rotation has converged in 6 iterations.

The second factor corresponds with “System availability”, with the exception mentioned of EFF5. It is noticeable that SAY1 loads equally on two factors.

The fulfillment factor of the original scale had split into two factors. One we labeled “Fulfillment: delivery” that seems very neat (FUL1, FUL4, FUL5). The second one, that we labeled “Fulfillment: schedule availability” is composed by FUL2, FUL6 and FUL7. It can be noted a pair of concerns about this factor. The first one is that FUL6 loads as well in the first factor; the other one is that FUL7 loads on the second factor.

Finally, the Privacy factor is very clear (PRI1, PRI2, PRI3). It exactly fits with the original in the Parasuraman *et al.*'s model.

This model has some resemblance with Boshoff (2007) model, where the initial fulfillment factor split into “Delivery (FUL1, FUL2 and FUL3)” and “Reliability (FUL4, FUL5 and FUL6)”. Note that these two factors are quite close to our factors “Fulfillment: delivery” and “Fulfillment: schedule availability”.

Next step was forcing the factor analysis to extract four factors, in order to know whether appears the original four factors of the E-S-QUAL scale. The percentage of variance captured was 63.57%. Nevertheless, it has to be noted that SAY1 and FUL7 continue loading in two factors with similar weights. Bearing in mind the recommendations of John and Reve (1982), both were removed, because their correlations with the sum of the subscale were low. The new exploratory factor analysis with four factors captured the 65.60% of the variance (table 4).

Table 4. Rotated factors removing SAY1 and FUL7 and forcing to extract four factors.

	Component			
	1	2	3	4
EFF4	.836			
EFF3	.694	.450		
EFF8	.667			
FUL6	.635			
EFF2	.623	.403		
EFF6	.593			
EFF7	.554	.469		
EFF1	.511		.416	
SYA3		.870		
SYA2		.834		
EFF5		.767		
SYA4		.704	.440	
FUL1			.813	
FUL4			.761	
FUL5			.727	
FUL2			.444	
PRI3				.898
PRI2				.887
PRI1				.846
Eigen-value	7.045	2.165	1.939	1.311

Method of extraction: Analysis of main components.

Method of rotation: Varimax normalization with Kaiser.

The rotation has converged in 6 iterations.

Comparing the three exploratory analyses conducted, it can be observed that the resemblance with E-S-QUAL improved from each model to the next tested. The last one provides high loads; there can only be found one below 0.5. Next step was assessing the reliability of each factor of this last model. Table 5 shows an acceptable level in the criteria usually used for this purpose (Hair et al., 1998). There were also performed four exploratory analyses, one for each factor, and all of them extracted only one factor. It assessed the unidimensionality of each item to its first order dimension. The four factors can be regarded as reliable, as the Cronbach alpha value for all of them exceeds the 0.7 normally regarded as the cut-off value for internal consistency (Nunnally and Bernstein, 1994).

Table 5. Reliability analysis of the subscales.

Subscale	Items	α of Cronbach	Range of α of Cronbach removing one item	Range of correlations of the items and the sum of the subscale
Efficiency	EFF1, EFF2, EFF3, EFF4, EFF6, EFF7, EFF8, FUL6	.876	.850 - .879	.470 - .732
System Availability	EFF5, SYA2, SYA3, (SYA4)*	.865	.808 - .862	.632 - .763
Fulfillment	FUL1, FUL2, FUL4, FUL5	.725	.607 - .732	.391 - .656
Privacy	PRI1, PRI2, PRI3	.878	.816 - .844	.746 - .781

* SYA4 is in brackets, because as it will be said, this variable was eliminated in the chosen model.

4.2 Confirmatory Factor Analysis

The first confirmatory factorial analysis performed was that shown in table 3, but the fit indexes rejected the model. This is the model that has a great similarity to Boshoff's model. Due to the size of the sample, a robust maximum likelihood estimation method was chosen. Comparative fit index (CFI) was .862 and the root mean-square error of approximation (RMSEA) .071. The data can not sustain Boshoff model.

The next confirmatory factorial analysis performed, using EQS software, was that shown in table 6. The fit statistics were not good enough. Satorra-Bentler scaled chi-square is 255.81 on 146 degrees of freedom. Comparative fit index (CFI) was .868, slightly below the recommended level by Byrne (1994). RMSEA (.068) and the 90% confidence interval limits of RMSEA (.054 and .081) were also just at the verge of acceptable levels. Hu and Bentler (1999) suggest a cutoff value of .06 for RMSEA. All the loads were significant. The Multi Lagrange test indicated that SYA4 loaded as well on the third factor. Nevertheless, a careful reading of this item does not seem that it should be in the fulfillment factor.

Precisely, next step was another confirmatory factor analysis eliminating this item (SYA4). The indexes improved. No special problems were encountered during optimization. Satorra-Bentler scaled chi-square was 196.69 on 129 degrees of freedom, with a p -value = .00012; CFI = .911; RMSEA = .057 and the 90% confidence interval limits of RMSEA were .040 and .072. Table 6 shows the loads, all significant at 0.05 significance level.

Table 6. Loads on quality factors.

Factor		
Efficiency	Loadings*	r^2
EFF1	.499	.249
EFF2	.658	.433
EFF3	.692	.479
EFF4	.753	.567
EFF6	.777	.603
EFF7	.792	.628
FUL6	.523	.274
System availability		
SYA2	.886	.785
SYA3	.750	.562
EFF5	.835	.698
Fulfillment		
FUL1	.787	.620
FUL2	.522	.272
FUL4	.687	.472
FUL5	.618	.382
Privacy		
PRI1	.817	.667
PRI2	.851	.725
PRI3	.858	.737

Goodness of fit statistics (Robust method)

χ^2	196.69
df	129
CFI	.911
Bentler-Bonett non-normed fit index	.895
Bollen's (IFI) fit index	.914
RMSEA	.057

* These are standardized loading estimates from Confirmatory Factor Analysis. All parameters significant at $p < 0.05$.

We conducted a new reliability assessment of System Availability. As expected, all the indicators were acceptable (α of Cronbach was .862).

After this initial reliability analysis performed, following Nurosis (1994) criteria, three items of the initial battery were eliminated (FUL7, SYA1, SYA4). The content validity of the scale was guaranteed by Parasuraman *et al.* (2005).

Construct validity was assessed considering two types of criterions: convergent and discriminatory validity.

Convergent validity was tested by checking that the factor loadings of the confirmatory model were statistically significant (level of 0.05) and higher than 0.5 points (Sanzo *et al.*, 2003). There is only one parameter that is just below (F1 – EFF1 = .499).

The discriminatory validity was confirmed through two criteria. Firstly, the correlation between the different variables in the confirmatory models was tested to make sure that they did not exceed 0.8 points as this would indicate a low discrimination between them (Bagozzi, 1994). Secondly, we tested that correlation between subscales were lower than their alpha coefficient (table 7).

Table 7. Factors' correlations

	Efficiency	System Availability	Fulfillment	Privacy
Efficiency	.876			
System Availability	.572(**)	.862		
Fulfillment	.493(**)	.264(**)	.725	
Privacy	.273(**)	.271(**)	.157(*)	.878

** Coefficients significant at $p < 0.01$ (bilateral)

* Coefficients significant at $p < 0.05$ (bilateral)

Cronbach's alpha coefficient on the main diagonal

5. DISCUSSION AND CONCLUSIONS

In spite that E-S-QUAL is quite young, it has opened a debate in order to assess whether it is an effective scale to measure the service quality offered by Internet retailers. Mainly, the few authors that at the moment have worked in this field agree that it is a good tool. The most critical is Boshoff (2007), although he has no inconvenience saying that at this moment, E-S-QUAL is an effective scale. Nevertheless, he proposes another one with six factors. Four of the new factors are quite close to the original model, but there have emerged two new. We also have found some support of these new factors. Actually, in our first exploratory factor analysis we got a model similar to the Boshoff's, nevertheless we could not confirm it.

Collier and Bienstock (2006) also applauded E-S-QUAL as an important step in conceptualizing e-service quality, although they propose a wider model. They add some new constructs. Their main objection is that E-S-QUAL uses only reflective indicators, whereas they state that e-service quality is made up of formative indicators.

We state that the E-S-QUAL scale works quite well applied to an online supermarket. We also find some clues about the differences detected in some dimensions of the quality attending at some attributes. It can be considered when the supermarket designs its website in order to address to a particular client target. In this sense, men found the site less efficient than women. In next years, when the men supermarket e-buyers percentage increases, it will be necessary to improve this dimension. Also regarded at this point, a gap has been detected in fulfillment between the categories established by the study attainment level. This dimension should be improved in order to satisfy people with lower study level. It is also important next years when this segment is going to increase their buying online and diminishing presence buying. It is especially accurate in Spain, where the supermarket assessed is located. Cristóbal and Marimon (2007) point out that in this country, there are a significant segment of e-buyers with low study attainment.

ACKNOWLEDGEMENT

This article was written as part of a research Project titled "The integrated management systems (IMS) on the Spanish companies" (SEJ2006-00682/ECON) financed by the Ministry of Science and Technology within the aid programmed for R+D projects.

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IN FINDING OF A GENERAL E-SERVICE QUALITY MODEL: A PRELIMINARY STUDY

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ABSTRACT

The main objective of this paper is to overview existing literature on e-service quality; how different authors understand quality parameters, which of them they find most important and what are the results of their researches, regardless of the method type. Once educated about previous findings, we want to make a transparent comparison, which would give us a basic guidance of what is out there and what still needs to be done in our further research work. Our main goal would be finding basic quality dimensions, which would most commonly describe an average e-service and evaluate its quality.

KEYWORDS

E-Service, E-Service Quality, Quality Framework, Quality Factors

1. INTRODUCTION

In the last decade quality of e-service has become an important issue, for e-service providers as well as for e-service users. Despite the large number of already existing e-services, users are facing significant problems concerning the level of their quality. We are still missing a simple application method for learning/evaluating, whether an e-service is good or not. There are no well-accepted conceptual definitions and models of service quality and its measurement (Seth et al., 2005). Much of the work in the field of e-service quality has been conducted in the areas of on-line retailing and on-line banking, and there has been limited attention to other services contexts (Rowley, 2006).

In searching for e-service quality definition researchers and e-service providers try to answer very common questions about what factors may help increase customers visitation on the site, what factors may influence customers to actually make purchase, what factors increase traffic flow to the site and what factors increase customer retention (Madu & Madu, 2002). A common question for e-tailors is what attributes increase consumer perceptions that online shopping is easy, useful, fun and safe (Ha & Stoel, 2008). The theory of attractive quality (Kano et al., 1984) has commonly been used in product development and service development processes to investigate the role of various quality attributes in customer's perception of quality (Witell & Löfgren, 2007). Most recently, the theory of attractive quality has been used to investigate various services (Witell & Löfgren, 2007), including e-services (Nilsson-Witell & Fundin, 2005). Since the first presentation of the theory of attractive quality authors have suggested variations of the original approach. But as seen in (Witell & Löfgren, 2007) different variations can provide different results because different approaches to the classification are built on different methodological foundations.

E-service quality is the key determinant for successful e-commerce, which currently represents a large part of overall commerce, online or not (Santos, 2003). In order to understand e-service experiences it is necessary to go beyond studies of e-service quality dimensions and to also take into account the inherent characteristics of e-service delivery and the factors that differentiate one service experience from another (Rowley, 2006). In the development of e-services, certain cost factors are significantly more important than others in relation to certain benefit factors (Lu & Zhang, 2003). Trust in the usage of e-services is often significant factor, because customers often need to release personal and/or financial data to the e-service provider (De Ruyter et al., 2001). Expertise, technique and expense are the principle factors limiting current e-service adoption (Lu & Zhang, 2003). The providing of useful information can be a very important factor and can have a greater effect on the purchase intent of customers (Lu & Zhang, 2003). Customers have

distinct levels of expectations with respect to the quality they desire and the quality they will find adequate in a service (Van Riel et al., 2003). For customers that purchase via the Web, relative advantage, or the extent to which the innovation is perceived to be superior to alternatives already available, results in higher service quality perceptions of the e-service and a higher intention to use it (De Ruyter et al., 2001). A good organizational reputation is also conducive to the adoption of e-services and a high level risk will scare customers to make use of e-service (De Ruyter et al., 2001). Companies have different motives for developing their e-service applications and different degrees of satisfaction for their e-service application they develop (Lu & Zhang, 2003). When a company is able to lift a customer's experience to a level, that exceeds that customers expectations, then the customer will be satisfied (Van Iwaarden et al., 2003). Because quality is an area of critical importance for commercial companies, businesses need to understand what attracts people to their Web sites, what keeps them there, and what keeps them coming back (Van Iwaarden et al., 2003). Although the relationship between customers and firms has become increasingly complex, the availability of information and communication technology has provided an opportunity to improve service quality through electronic interactions. If correctly applied, the internet is a powerful tool that allows public-service managers to reduce costs, increase efficiency, and build profitable customer relationships (Ancarani, 2005).

This paper is organized in the following way: in the next section we are going to give out some definitions of e-service and e-service quality found in the literature. Third chapter holds information about the previously work, found in existing literature. In the last chapter we conclude our literature review and make plans for our future work, based on what we learned to be an undeveloped field in e-service quality.

2. E-SERVICE AND E-SERVICE QUALITY

In the existing literature we can find different definitions of e-services, so there is a need of one e-service definition. Definitions of e-services found in the literature are mostly based on definitions of traditional services, mashed up with advanced telecommunication and information technologies. Examples of e-service definitions are:

- E-service is an interactive, content-centered and Internet-based customer service, driven by the customer and integrated with related organizational customer support processes and technologies with the goal of strengthening the customer-service provider relationship (De Ruyter et al., 2001).
- E-services are distributed services that can be accessed programmatically on the Internet, using SOAP messages and the HTTP protocol (Su et al., 2004).
- E-service is deeds, efforts or performances whose delivery is mediated by information technology (including the Web, information kiosks and mobile devices). Such e-service includes the service element of e-tailing, customer support and service, and service delivery (Rowley, 2006).
- E-service is "an act or performance that creates value and provides benefits for customers through a process that is stored as an algorithm and typically implemented by net worked software" (Hofacker et al., 2007).
- E-service quality can be defined as overall customer evaluations and judgments regarding the excellence and quality of e-service delivery in the virtual marketplace (Santos, 2003).

In the past a great deal of effort has been made to deliver the most important dimensions of quality of traditional services. Lately researches are paying big attention in development of e-service quality dimensions. As we can see in the existing literature, researchers are mostly trying to extend quality models of traditional services with quality factors adequate to e-service characteristics. In the next chapter we are summarizing different views of e-service quality, found in existing literature. As we will see, there is no single e-service quality definition, since authors were mostly building and testing their e-service quality models for various e-service domains.

3. PREVIOUS WORK

An attempt to identify dimensions of e-quality has been made by (Madu & Madu, 2002). With the synthesis of existing literature authors identified 15 quality dimensions for evaluation of virtual service operation.

Their dimensions didn't take any investigation of the importance or non-importance and therefore further analysis and research in this field remains open. (Fassnacht & Koesse, 2006) developed a hierarchical quality model for electronic services which includes three dimensions and nine sub-dimensions. Main dimensions are: environment quality (related to the appearance of the user interface), delivery quality (which is referred to the quality of customer-web site interaction during service usage) and outcome quality (the result of the service use).

It is very important to consider how the combination of online and offline effects on customer's e-experience. A conceptual framework for customer satisfaction and loyalty was built by (Semeijn et al., 2005). Authors identified the following attributes that contribute to e-service quality: navigation, e-scape, responsiveness, customization, assurance, accuracy, online value, online joy, satisfaction, loyalty. They tested their e-service quality framework through an online survey, with focus on four different online industries.

Much of the reviewed work by (Santos, 2003; Rowley, 2006) is occupied with a combination of traditional service quality dimensions, coupled with web interface quality dimensions and is based on consumer expectations and/or perceptions of service quality. Rowley proposed for further testing and research the following dimensions that contribute to customer experience of e-service: site features, security, communication, reliability, customer support, responsiveness, information, accessibility, delivery and personalization. The author is also exposing the scope for further work on measurement of e-service quality in other contexts, and specifically in information provision and digital content delivery.

Comprehensive research on quality evaluation of B2B applications has been done by (Behkamal et al., 2008). Within their study they found the ISO 9126 model a good basis to build a quality model for quality evaluation of B2B applications. With a questionnaire that was sent to developers and also to end users, authors derived weights of the quality factors and sub-factors. With review of existing research in quality metrics for e-commerce systems they identified four additional quality characteristics, not included in the ISO model. These are traceability, availability, customizability and navigability.

The definition of e-government quality services was presented in (Halaris et al., 2007). Authors have analyzed 36 different quality approaches concerning public sector services, e-services in general and more specifically e-government services. Based on the approaches they found in literature, they built a classification of what a quality model must address. They synthesized existing quality approaches into a classification consisting of four layers: 1) back office process performance layer, addressing factory mainly found in quality models for traditional government services; 2) site technical performance layer, addressing the factors of the technical performance of the site, i.e. site reliability, security, etc.; 3) site quality layer, addressing the factors of the site usability, and interface; and 4) customer's overall satisfaction addressing the overall level of quality perceived by the user against user's expectations. After the classification the models were categorized into five categories: traditional, citizen satisfaction, web site quality, web site quality factors and technical approaches. An important recognition after the classification is that there are no objective quality measures that can be used for the qualitative assessment of public e-services by users/citizens (Halaris et al., 2007).

Users' perceived portal service quality was identified and measured in (Kuo et al., 2005). Portal service quality model has been presented as a multi-dimensional scale based on the traditional SERVQUAL model presented in (Zeithaml et al., 1990). Their quality model consists of the following measurement variables: convenience, empathy, ease of use, information quality, fun, reliability, responsiveness, accessibility and other criteria. Authors used a questionnaire for data collection. After data analysis they got to conclusion, that the success of web portals is closely related to four factors: information quality, accessibility, ease of use and empathy. Information quality is the most important factor for customer satisfaction.

The perceptions of rational customers regarding online shopping could be understood by a model, based on these quality dimensions: web site design, reliability, responsiveness, trust and personalization (Lee & Lin, 2005). Trust is found to be as the most strongly affected overall service quality and customer satisfaction for online stores. Reliability is the second most important predictor of overall service quality. Responsiveness has a mild affect since end users are mostly tolerable to slower financial interactions. Both web site design and personalization have next to none effect on overall quality. Study by (Lee & Lin, 2005) showed a positive relationship among overall service quality, customer satisfaction and purchase intentions in an online store.

E-service quality of web sites and online shopping sites can be presented as a set of incubative and a set of active dimensions. The incubative dimensions can be used during the design phase of the Web site for

ensuring that: 1) the Web site is easy to use, search and navigate, 2) it has an appealing appearance to its target customers, 3) links are set up and maintained, and that broken links are avoided, 4) the site has a well-organized structure and layout, and 5) there is an attractive presentation of factual contents. Active dimensions can be used after the Web site was launched in order to satisfy end users. The determinants of active dimension are: reliability, efficiency, support, communication, security and incentive. The e-service quality model found by (Santos, 2003) doesn't provide any specific measurement scales. The author is aware of the need for development of an appropriate instrument to measure e-service quality for on-line suppliers. The main limitation of their research is that they were focused only on online shopping and on web sites that the members of focus groups came up with. Their work has a lack of investigation in quality dimensions for different types of e-services (B2C, G2B, G2C, etc.).

The impact of organizational reputation, relative advantage, and perceived risk on perceived service quality, trust and behavioral intentions of customers towards adopting e-services has been investigated in (De Ruyter et al., 2001). The author identified three dependent variables for the hypotheses: 1) perceived service quality, reflecting the customer's attitude towards e-service, 2) trust and 3) intention to use. The results of an experimental study show that the three factors have a significant main effect on the customer's attitude and behavior towards e-service. The only exception is that relative advantage does not appear to have a significant impact on customer trust (De Ruyter et al., 2001). Efficiency, fulfillment, system availability, privacy are the main components of e-service quality that are linked to trust and satisfaction (Sahadev & Purani, 2008).

A methodology for measuring the quality of e-service in terms of functional quality was proposed by (Ancarani, 2005). The framework is used for measuring information, interaction, two-way interaction and transaction. Author defined an evolutionary path of e-service based on the relationship between benefits for customers (in terms of functional quality of e-service) and web site technological complexity. Author used a four-stage framework described by (Aichholzer et al., 1998) to measure the level of online sophistication of the services.

To learn how customers evaluate portal sites and develop e-loyalty (Van Riel et al., 2001) developed a framework for the e-service offering divided into five e-service components: the core services, facilitating services, supporting services, complementary services, and the user interface. Authors explored how satisfaction with online service offers affects value perception, customer satisfaction and loyalty. In their study, authors got to conclusion, that satisfaction with all of the components of the framework influences the overall satisfaction with a portal. An interesting finding is, that user interface has no effect and that supplementary services (travel information, download finances, supply, etc.) are more important than core services (journal, news, advise, etc.). Main limitation of the study presented in (Van Riel et al., 2001) is that, it is focused only on one particular type of e-service and no more than one portal site has been studied.

Based on e-service applications in Australia in private and public sectors four categories for assessing e-service applications from a provider's perspective were defined by (Lu & Zhang, 2003): e-service function (capability and quality), e-service cost, e-service benefit and e-service development. The authors composed the research framework based on previous work found in the literature and used the framework for data collection from different companies. The study showed that development type has a great influence on the degree of user satisfaction. The results also showed that cost factors are significantly more important than benefit factors.

Table 1. Quality models found in existing literature

Author/s	Context	Quality factors/dimensions	Based on	Research method
(Van Riel <i>et al.</i> , 2001)	web portals	the core services, facilitating services, supporting services, complementary services, the user interface	Literature review and interviews	Questionnaire
(De Ruyter <i>et al.</i> , 2001)	general	organizational reputation, relative advantage, and perceived risk on perceived service quality, trust and behavioral intentions of customers	Literature review	Experimental study
(Madu & Madu, 2002)	general	performance, features, structure, aesthetics, reliability, storage capability, serviceability, security and system integrity, trust, responsiveness, product/service differentiation and customization, web store policies, reputation, assurance, empathy	Literature review	N/A

(Zeithaml <i>et al.</i> , 2002)	web sites	Information availability and content, ease of use or usability, privacy/security, graphic style and fulfillment	Literature review	Literature review
(Van Iwaarden <i>et al.</i> , 2003)	web sites	SERVQUAL: tangibles, reliability, responsiveness, assurance, empathy	SERVQUAL	Questionnaire
(Lu & Zhang, 2003)	general	cost, benefit, functions and development	Literature review	Questionnaire
(Santos, 2003)	on-line shopping, e-commerce	ease of use, appearance, linkage, structure and layout, content, reliability, efficiency, support, communication, security and incentive	Literature review	Exploratory research, focus groups
(Van Riel <i>et al.</i> , 2003)	online flight reservations	design of the user interface, responsiveness, reliability, customization, security	SERVQUAL	Questionnaire
(Ancarani, 2005)	web sites, public e-services	information, interaction, two-way interaction, transaction	Aicholzer's framework	Literature review
(Kuo <i>et al.</i> , 2005)	web portals	convenience, empathy, ease of use, information quality, fun, reliability, responsiveness, accessibility, other criteria	SERVQUAL	Questionnaire
(Lee & Lin, 2005)	on-line shopping	web site design, reliability, responsiveness, trust and personalization	SERVQUAL	Questionnaire
(Semeijn <i>et al.</i> , 2005)	general	navigation, e-scape, responsiveness, customization, assurance, accuracy, online value, online joy, satisfaction, loyalty	Literature review	Questionnaire
(Fassnacht & Koesse, 2006)	general	environment quality (graphic quality, clarity of layout), delivery quality (attractiveness of selection, information quality, ease of use, technical quality), outcome quality (reliability, functional benefit, emotional benefit)	Literature review	Questionnaire
(Rowley, 2006)	general	site features, security, communication, reliability, customer support, responsiveness, information, accessibility, delivery and personalization	Literature review	Informal analysis of existing literature
(Halaris <i>et al.</i> , 2007)	e-government	back office performance layer, site technical performance layer, site quality layer, customer's overall satisfaction	Literature review	Classification of approaches in literature
(Behkamal <i>et al.</i> , 2008)	b2b applications	<i>functionality</i> (suitability, accuracy, interoperability, security, traceability), <i>reliability</i> (maturity, fault tolerance, recoverability, availability), <i>usability</i> (understandability, learnability, operability, attractiveness, customizability, navigability), <i>efficiency</i> (time behavior, resource utilization), <i>maintainability</i> (analyzability, changeability, stability, testability) and <i>portability</i> (adaptability, install ability, co-existence, replace ability)	ISO 9126	Descriptive-analytical method + case study
(Ha & Stoel, 2008)	online shopping	web site design, customer service, privacy/security, atmospheric/experimental	Literature review	Questionnaire, TAM
(Sahadev & Purani, 2008)	job portals	efficiency, fulfillment, system availability and privacy	Literature review	Literature review, a survey of users

(Van Riel *et al.*, 2003) adapted the SERVQUAL model and got to a quality model with five e-service quality dimensions: design of the user interface, reliability, security, customizations and responsiveness. According to their research results online customers have the smallest zone of tolerance for the two quality dimensions they find most important: security and reliability. With the limitation of the study focusing only on one type of the e-service a replication to different categories of e-service should be performed.

(Van Iwaarden *et al.*, 2003) got to the conclusion, that quality dimensions applicable in the service sector are also applicable to web sites. The most important items in relation to quality are tangibles (the appearance of the Web site, navigation, search options, and structure), reliability (the ability to judge the trustworthiness of the offered service and the organization performing the service), responsiveness (the willingness to help customers and provide prompt service), assurance (the ability of the Web site to convey trust and confidence in the organization behind it with respect to security and privacy), and empathy (the provision of caring,

individualized attention to customers, including user recognition and customization). The most important quality aspects found in their study are: fast access, simple finding your way on the site.

Table 1 summarizes reviewed studies of e-service and e-service quality. As we can see, the e-service quality models found in reviewed studies are mostly built on the quality models, found in existing literature.

4. CONCLUSION WITH FUTURE RESEARCH DIRECTIONS

From the analysis of e-service quality dimensions identified in existing literature it is evident that much of the work has been conducted in the areas of online retailing and online banking, and there has been limited attention to other services contexts (Rowley, 2006). Existing literature is still missing a general conceptual model of e-service quality. We have seen attempts toward e-service quality definition in several existing papers like (Christos Halaris et al., 2007; Gwo-Guang Lee & Hsiu-Fen Lin, 2005; Jennifer Rowley, 2006; Jessica Santos, 2003; Ko de Ruyter et al., 2001; Nitin Seth et al., 2005; Tsuang Kuo et al., 2008). In all these studies authors were mostly limited to one e-service domain or type.

After all those findings from different literature, there is obviously a need for general quality model that can be used to measure any type of existing e-services and e-services in development. The quality model must measure and monitor all quality aspects and dimensions of an e-service. How to identify the right quality dimensions and factors of e-service quality? Is it possible to build a general quality model for e-service quality evaluation that could be used for any type of e-service? These research questions will be addressed in our future research work. An empirical research will be performed for design of quality framework for e-service quality evaluation.

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LEVERAGE E-SERVICES ADOPTION WITH SYNTHESIS OF EXISTING KNOWLEDGE

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ABSTRACT

A lot of research has already been performed in the field of e-service quality and acceptance. However, there is still a gap between available e-services and percentage of regular internet users on one side and amount of used e-services on the other side. The purpose of our article is to highlight some problems of existing research activities in e-service domain and to present some solutions, which could leverage existing research activities to increase e-service adoption. The practical outcome of this article is a proposal for an ontology based knowledge system, which could reduce the gap between e-service researchers and e-service practitioners.

KEYWORDS

E-service, TAM, ontology, adoption, taxonomy, e-service quality.

1. INTRODUCTION

“E-Service” is a generic or umbrella term which usually refers to the provision of services over the Internet. E-Services represent the focal concept of information society and digital economy. The i2010 Mid-Term Review (European Commission 2008) reports that today’s businesses in the EU devotes 20% of investment to ICT¹, and the sector accounts for 26% of overall research expenditure. Moreover, the same review reports that 60% of basic public services are already fully available online and more than half of EU citizens use the Internet regularly.

Compared to “traditional” services, e-services raise some expectations including (1) increased productivity, (2) reduced costs for producers and consumers of e-services and (3) increased accessibility. However there are also known and unknown drawbacks of e-services, which impact potential e-service users of not using them. A lot of research has already been performed in this area, commonly resulting in conceptual models, which demonstrate the causal dependencies between different e-service related factors (Scarpi, Riley, & Manaresi 2007; Zhang & Prybutok 2005). These models have great potential for e-service related stakeholders for example they can help to develop more user-oriented e-services.

However, from the i2010 Mid-Term Review (European Commission 2008) is also evident that there is a gap between the high amount of available e-services (Figure 1) and low percentage of those e-services, which are actually used (see bordered lines on Figure 1).

¹ Information Communication Technologies

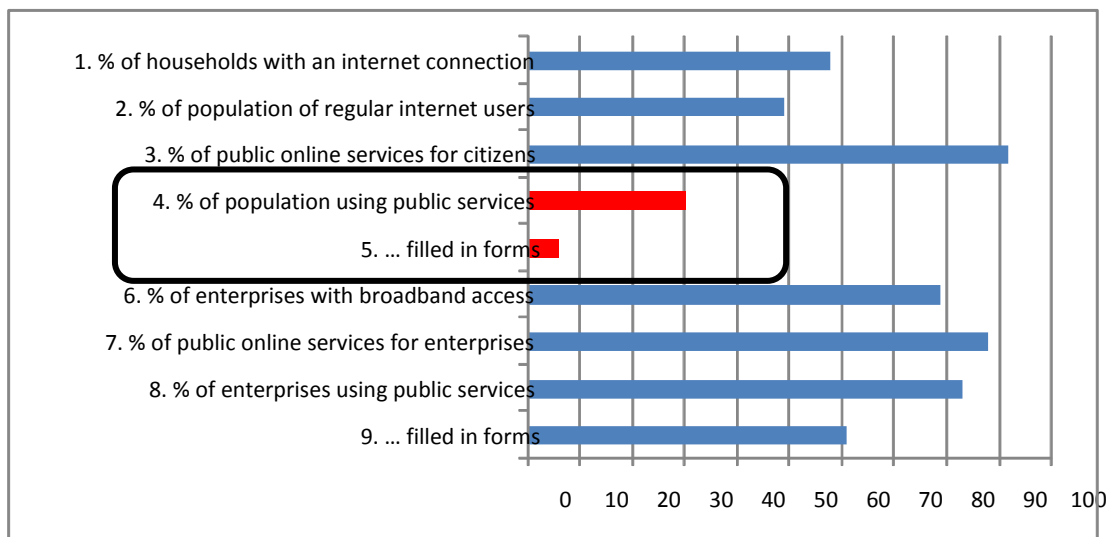


Figure 1. Abstracted from i2010 Mid-Term Review statistics for Slovenia for 2007

So, we believe that despite of existing research, there are still open issues in the field of e-services adoption, which raise following research question: “How to improve the adoption and continued use of e-services considering the results of existing research activities?”

2. ANALYSIS OF EXISTING RESEARCH

In order to answer the research question, we started research activities with a systematic literature review. In the literature review we focused on identifying existing theories and investigated factors in the context of e-services, which are related to e-service adoption (Figure 2). The search space for literature review embraced journals which are managed in “www.sciencedirect.com” database.

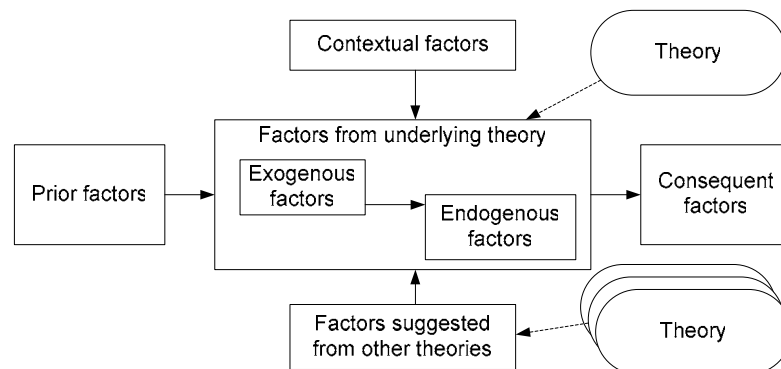


Figure 2. The model for analysis of existing research

According to Figure 2, the focus of performed literature review was on identifying research which is based on causal models. Within those models, we identified underlying theory (if any) and eventual extensions of the theory into one of the following areas: (1) factors, which are specific to investigated context (e-services), (2) factors which are prior to the theory factors, (3) eventual consequent factors or theory implications and (4) factors, which combine the focal research theory with other theories. Summary of literature review is presented in Table 1.

Table 1. A sample of literature which is relevant to e-service adoption²

Article	Focal theory & Focal factors (ex/en) ³	Prior factors	Contextual factors	Factors from other theories	Consequent factors
(Ha & Stoel 2008)	Technology acceptance model (TAM): - Usefulness (en) - Ease of use (ex) - Attitude (en) - Intention to e-shop (en)	E-shopping quality: - Privacy /security - Web site design - Customer service - Atmospheric		- Trust - Enjoyment	
(Sukasame 2005)	E-service quality: - Content - Accessibility - Reliability - Responsiveness - Security - Self service			- Satisfaction - Trust - Ease of use	- Success
(Heim & Field 2007)	E-service quality: - Website design - Reliability - Security - Customer service	E-service process attributes			- Overall satisfaction - Customer Loyalty
(Chen & Tan 2004)	Technology acceptance model (TAM): - Perceived usefulness (en) - Perceived ease of use (ex) - Attitude (en) - Behavioral intention (en) - Actual use of virtual stores (en)	- Product offerings - Information richness - Usability of storefront	- Perceived service quality	- Perceived trust - Compatibility	
(Harris & Goode 2004)	- Perceived value - Trust - Satisfaction	Service quality			- Loyalty
(Kim & Stoel 2004)	Website quality: - Web appearance - Entertainment - Informational fit to task - Transaction capability - Response time - Trust				- Satisfaction
(Lee, Cheung, & Chen 2005a)	Technology acceptance model (TAM): - Usefulness (en) - Ease of use (ex) - Attitude (en) - Intention to use Internet-based learning med (en).			- Perceived enjoyment	

The literature review resulted in a remarkable amount of literature, which is related to the stated research problem. Therefore, we believe that other researchers are already well acquainted with e-service adoption problem. However, we believe that existing research results could be better used in e-service domain, especially by e-service technicians and practitioners. Some proposals are presented in the next section.

² Because of limited space all relevant results were not included in the Table 2.

³ (ex) = exogenous factor, (en) = endogenous factor.

3. PROPOSED SOLUTION

In order to leverage the adoption of e-services, we propose some solutions, which complement existing research. These solutions are presented in next subchapters.

3.1 Common Theory

We intend to formalize and synthesize existing research using a common theory. The most common theory in the field of adoption is Technology Acceptance Model - TAM (Davis 1989) and its extensions, which are presented in King & He (2006) meta-model. Their meta-model has already been used in our literature review, as a foundation of the model presented on Figure 2. We believe that TAM and its extensions could be used for identifying, classifying, linking and comparing of the factors and results of e-service body of knowledge.

Second, while different authors conceptualize e-service success (see consequent factors on Table 1) in different ways, it is practically impossible to compare their results. An uniformity in this area could be achieved using Seddon's IS Success model (Seddon 1997). Seddon's model is well suited because it defines abstract categories of IS Success and their interdependencies. In addition, it relates IT adoption factors (IS behavioral model) to IS success. This means that e-service adoption and e-service success could be investigated in an integrated causal model, based on e-service quality, TAM and Seddon's IS success model (Figure 3). The basics for the (technological) quality factors of e-services could be obtained from ISO/IEC 9126 Software product quality model (ISO 9126 2001).

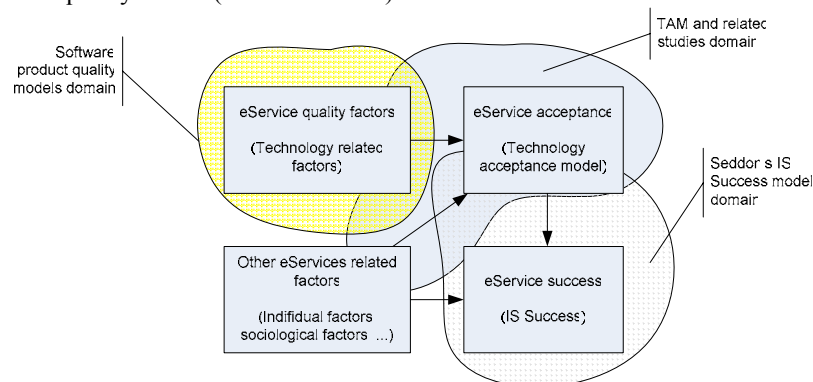


Figure 3. A high-level e-service causal model

3.2 Synthesis of Existing Knowledge

This idea is driven by the following quotation: *“Total is more than the sum of the parts”*. We believe that this idea can be applied to existing e-service studies, which are commonly unrelated and overlaying. An example of overlaying of three independent e-service studies (Lee, Cheung, & Chen 2005b; Ribbink et al. 2004; Semeijin et al. 2005) is presented on

Figure 4, with many overlaying concepts.

To bypass these problems, we propose to define ontology (specification of conceptualization) of knowledge in the field of e-services, which would include the results of existing research and relationships between researches. We believe that such ontology would offer several advantages compared to current knowledge:

- a better overview of already performed research,
- an easier way to identify contradict research results,
- an easier way to generalize the results, which were performed in different sample frames, contexts and environments,
- a better way to identify non-validated or missing relationships between concepts,
- a better way to identify or defines laws and theories in the field of e-services and
- a good starting point for e-service researchers in general.

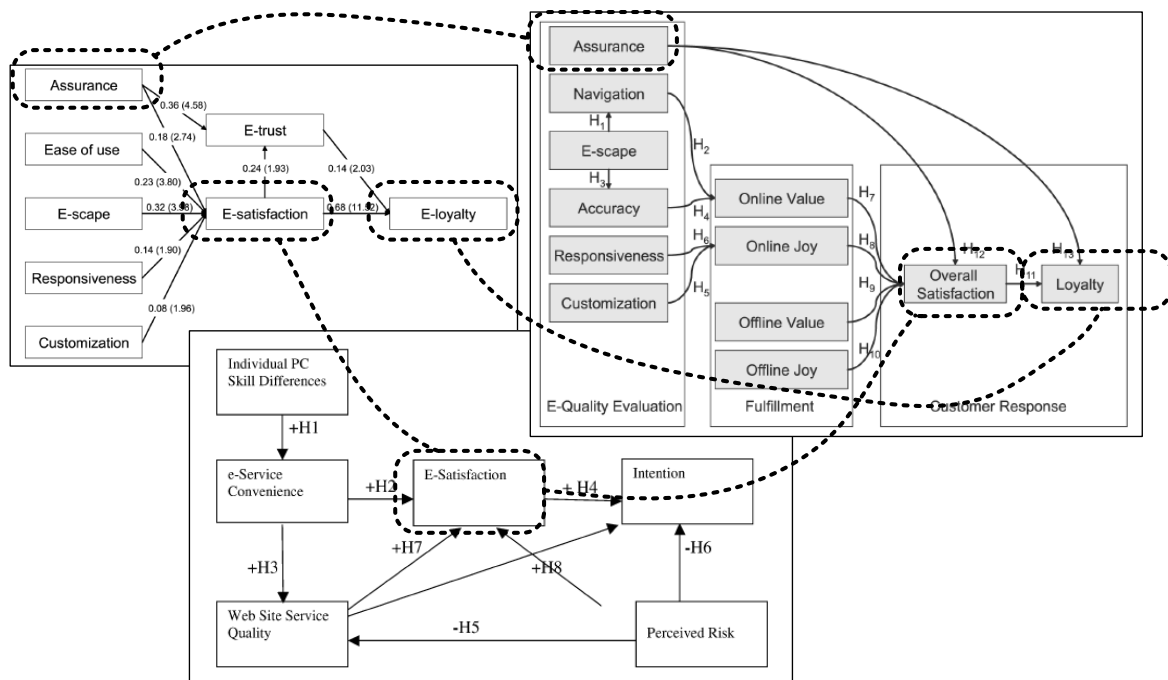


Figure 4. An example of overlaying of existing e-service research (squared concepts and dotted lines)

Proposed ontology could be implemented using semantic web technologies, which includes Resource Description Framework (RDF). RDF models are able to incorporate all the information from causal models including: concepts, observed variables, causal relationships, regression weights, significance levels, variance explained, models fit, etc.

3.3 Presentation of Research Results

There are several challenges for presenting the existing e-service knowledge to relevant stakeholders. First, the e-service researchers usually investigate specific e-service sub-types, where it is unknown, how different sub-types and their characteristics are interrelated. So, we believe that a common taxonomy of e-services is required, as presented on the Figure 5.

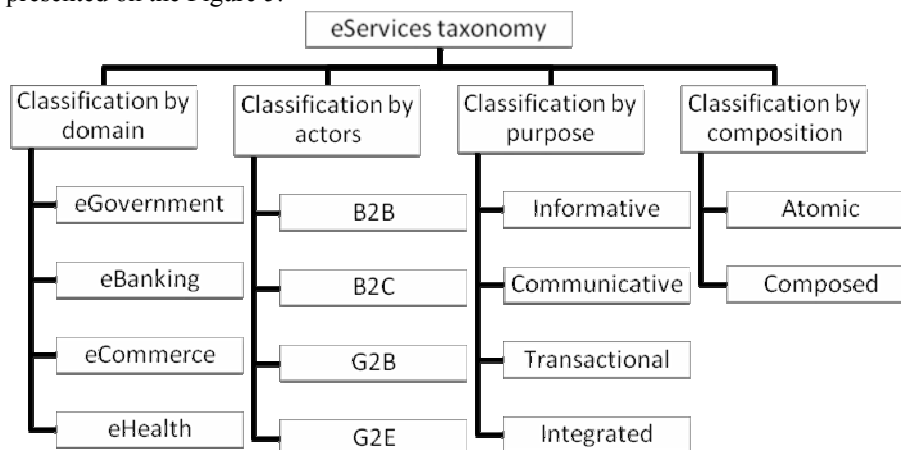


Figure 5. An example of e-services taxonomy

We believe that the taxonomy would organize e-service's properties, their instances and put different e-service researches in appropriate e-service context.

Second, we believe that both, the causal models, which represent the focal point of e-service research and e-service ontology which was presented above, are not suited for e-service practitioners (e-service developers and consumers) for several reasons: (1) the results are usually published in scientific papers which are managed by specific document bases with limited access; and (2) the results are scientific and therefore difficult to understand.

We believe that a better way of presenting knowledge to e-service practitioners would be to transform ontology-based knowledge into a more human-oriented guidelines, composed of structured or plain text. The whole process of exchanging knowledge between e-service researchers and their practitioners is presented on Figure 6 using Business Process Modeling Notation (BPMN).

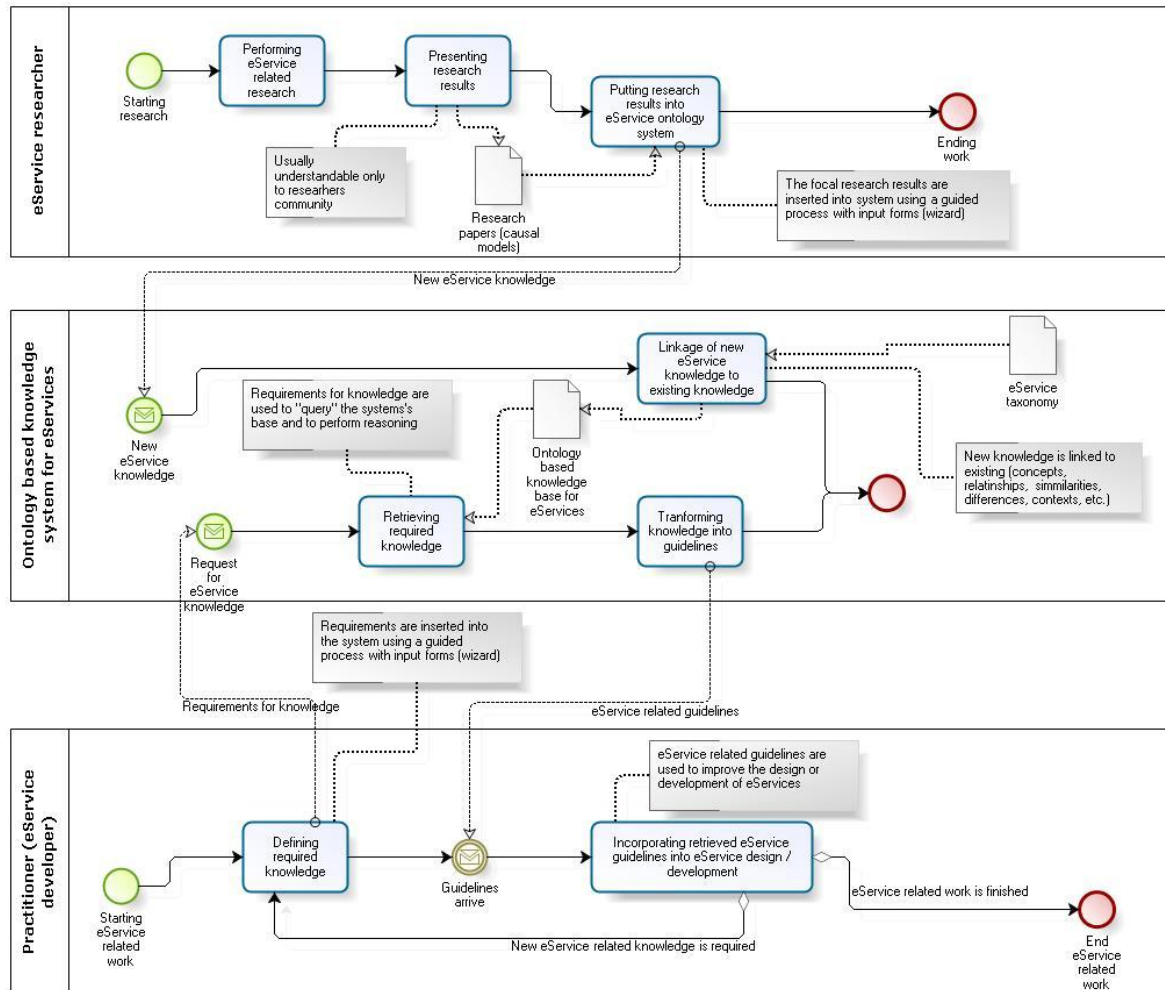


Figure 6. Knowledge exchange process between researchers and practitioners using ontology based knowledge system

The process on Figure 7 involves three different sub-processes (two human related processes and a knowledge system), which transform e-service related knowledge “from scientific view to practitioners view”. The focal task of researcher is to put the results of their e-service related research into the knowledge system, which inter-relates the information with existing system’s knowledge. The practitioner “queries” the system for desired information using a guided process. If available, the system returns information in a form of structured text based guidelines.

4. FUTURE RESEARCH ACTIVITIES

In this article, we presented some ideas on how to increase the adoption and continued use of e-services. We found this research reasonable because we identified a gap between (1) available and used e-services and (2) a gap between available e-service related knowledge and amount of applied knowledge.

While our research is still in its starting phase, we identified following threats and limits of it. First, the analysis of existing research, which was presented in the article, is still in the progress. So, we were able to present only partial results of literature review, which might not be a representative picture of complete literature or knowledge in the area. Second, the solutions to the stated problem were not analyzed and designed in details. So, we were not able to present any limits of proposed solutions. In addition, we did not search for similar solutions, which may exist in other fields of science.

According to this we plan following future activities: (1) we plan to perform a complete meta-analysis of existing (causal) knowledge in the field of e-services; (2) based on meta-analysis we plan to establish e-service ontology and (3) perform a case study which would investigate actual benefits of such ontology. Based on these results we will decide on how to implement a knowledge system for e-service related knowledge exchange between researchers and practitioners.

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ONTOLOGIES FOR DEFINITION AND MANAGEMENT OF E-ADMINISTRATION PROCESSES

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ABSTRACT

One of the applications of workflow systems are administrative management processes characterized by the transmission of perfectly defined information elements among users of an organization. These tasks are carried out sequentially, where users are consecutively responsible for confirming, modifying or adding information to the end of processes. These processes need to be defined in workflow management systems which all the elements are perfectly identified and are easily adaptable to changes that may arise in the sequences of tasks, in the users involved or in the data transmitted from one task to another. For this kind of processes, the use of ontologies allows clean definition and easy adaptation of an organization's management processes. This paper proposes a complete model, together with the necessary software tools, for tackling this issue.

KEYWORDS

Workflows, ontologies, business process, e-administration, administrative management processes

1. INTRODUCTION

Workflow is the automation of a business process, in whole or in part, during which documents, information, or tasks are passed from one participant to another for action, according to a set of procedural rules. A Workflow Management System (WfMS) is able to interpret the workflow definition and creates and manages the execution of these workflows. Specifically, van der Aalst (Van der Aalst, 2002) states that "a WfMS ensures that the right information reaches the right person at the right time, or is submitted to the right computer application at the right moment". Workflow Management Coalition (WfMC¹) is making a great effort to standardize these systems to facilitate their widespread application. Moreover, in the last few years, WfMS are gaining popularity thanks to reports that identify Business Process Management (BPM) as the number one business priority (Gartner, 2005).

Traditionally, workflows are classified in three kinds of workflow (McReady, 1992): ad hoc, administrative, and production. Ad hoc workflows perform office processes, such as product documentation or sales proposals, where there is no set pattern for moving information among people. Administrative workflows involve repetitive, predictable processes with simple task coordination rules, such as routing an expense report or travel request through an authorization process. The ordering and coordination of tasks in administrative workflows can be automated. Production workflows involve repetitive and predictable business processes, such as loan applications or insurance claims. Unlike administrative workflow, production workflows typically encompass a complex information process involving access to multiple information systems.

On the other hand, Georgakopoulos and colleagues (Georgakopoulos, 1995) characterize workflow along a continuum from human-oriented to system-oriented. At one extreme, human-oriented workflow involves humans collaborating in performing tasks and coordinating tasks. The requirements for WfMSs in this environment are to support the coordination and collaboration of humans and to improve human throughput. Humans, however, must ensure the consistency of documents and workflow results. This kind of workflows requires particular graphical user interface concepts. The main concept is the work item list that is used by

¹ <http://www.wfmc.org>

workers in order to interact with the system. At the other extreme, system-oriented workflow involves computer systems that perform computation-intensive operations and specialized software tasks.

Lastly, Weske (Weske, 2007) classifies workflows in single-application or multiple-application. A single application workflow consists of activities and their causal and temporal ordering that are realized by one common application system. A multiple-application workflow contains activities that are carried out by multiple application systems, providing an integration of these systems.

Certain types of simple business processes exist, generally in the administrative or legal ambit, characterized by the sequential transmission among users of straightforward and well structured information elements in which the user or users in charge of the task must confirm, modify or add new information until said process ends. This type of processes do not usually require a complex workflow management system with advances characteristics such as coordination with other external applications or different possibilities in the process flow control or in its events. Basically this type of processes need to be supported by workflow management systems easily adaptable to changes that may occur either in the task sequences in the uses involved in said task or in the data transmitted among users. As example of this type of processes we may cite all those initiated by a user and must be attended to or evaluated by other different user following a perfectly defined protocol about data, times and agents involved. This would refer to processes laid down by laws, rulings of action or protocol executions in public institution or large companies. Examples could be the management of public contest bids, holiday application procedure or notification of an incident in a company's information system.

Concerning the previous classifications, the workflow system that manages this type of process is an administrative, human-oriented and single-application workflow system and which additionally is easily adaptable to the changes in the data elements that it is managing

With the aim of managing processes with these characteristics, this paper proposes a model that represents the definition of business processes by means of ontologies and, at the same time, presents a workflow management system which works with such representations. This proposal enables the perfect identification and easy adaptation of the data used, the processes which manage it and the users involved in said processes thanks to the advantages of integration and reutilization that the ontologies provide.

This paper is structured as follows: section 2 presents existing works that apply ontologies to workflow management systems and section 3 details the model composed of ontologies and the workflow management system.

2. RELATED WORKS

In recent years, some interesting approaches have appeared in ontological engineering applied to improving WfMS. The most recognized are:

Vieira and colleagues (Vieira, 2004) is one of the first works integrating both fields in 2004. This paper proposes a solution to make workflow execution more flexible in the presence of incomplete information, by adopting presuppositions, and in the presence of negative information, by suggesting execution alternatives. This paper also presents an architecture for the workflow system, which is driven by ontologies that capture semantic relationships between workflows, resources and users.

In that year, Pathak and colleagues (Pathak, 2004) develop ontology-extended workflow components and mappings between ontologies to facilitate assembly of ontology-extended, component-based workflows using semantically heterogeneous workflow components. The proposed ontology-extended component-based workflows provide a theoretical framework for assembly of semantically well-formed workflows from semantically heterogeneous information sources and software components.

One year later, Zdravkovic and colleagues (Zdravkovic, 2005) propose a methodology which, using a layered contract ontology, deduces contract requirements into a high-level process description named Contract Workflow Model (CWM). By applying a set of transformation rules, the CWM is then compared for compliance with existing, executable process models. By the use of its concepts, the methodology enables comprehensive identification and evolution of requirements for interoperability of processes of the contracting parties.

In 2006, one work that stands out is the work of Gasevic and colleagues (Gasevic, 2006). The main idea of this paper is that the Petri net ontology should provide the necessary Petri net infrastructure for the

Semantic Web. The infrastructure understands Petri nets sharing using XML-based ontology languages (i.e., RDFS and OWL). Petri nets have been widely applied in system, modeling and analysis for many years.

Haller and colleagues (Haller, 2006) present a multi meta-model process ontology (m3po), which is based on various existing reference models and languages from the workflow and choreography domain. The mp3o ontology relates workflow models to choreography models and allows choreography extraction from internal workflow models.

In 2007, Abramowicz and colleagues (Abramowicz, 2007) present a semantically enhanced Business Process Modeling Notation (OMG, 2006), namely the sBPMN ontology. The sBPMN ontology overcomes problems with composition and execution of processes based on the models designed by business analysts. sBPMN proposes to use ontologies as a fundamental basis and it provides not only hierarchy, but also axioms and mapping to an upper process ontology (UPO).

In general, each one of these approaches uses ontologies in the workflow field incorporating the benefits of reuse, consistency and shared consensus knowledge of ontologies. Our approach applies the advantages of ontologies to the administrative management processes domain where managers may define the processes, it is easy reuse existing processes, and the case data and users may be modified and incorporated into the system without modifying the definition of processes.

3. A WORKFLOW MODEL BASED ON ONTOLOGIES FOR PROCESSES OF ADMINISTRATIVE MANAGEMENT

3.1 Ontologies for the Representation of Workflows

In recent years, the use of ontologies when it is necessary to represent knowledge in any domain are becoming ever more frequent, both in reasoning and knowledge-based systems as well as in traditional information systems. Ontologies have been used in the field of Artificial Intelligence for Knowledge Engineering, in natural language processing and in basic knowledge representation. Today they are also being widely used in fields such as intelligent information integration, cooperative information systems development, information retrieval, e-commerce and knowledge management (Davies, 2002).

The reason for ontologies success is derived from their design criteria, which was described by Gruber (Gruber, 1995): clarity, coherence, extendibility, minimal encoding bias and minimal ontological commitment. Following this approach, ontologies are designed with the aim of their knowledge being easily reusable and shared by the communities of the same domain. In this way, the taxonomy of concepts which represents a domain should be complete, with properties and relationships that categorize all terms precisely, and with definitions in natural language to describe their meaning. Therefore, ontologies can be used by software agents to exploit the knowledge represented and also by people in order to share the vocabulary in a domain. Recently, the general acceptance of a single language of representation such as OWL² and the development of tools like Protégé³ for the construction of ontologies has favored wide use of ontologies in many fields, especially in the Semantic Web.

Among other uses, ontologies are used as a common element of unification and integration of information. For example, ontologies are used to integrate heterogeneous relational databases (Dou, 2006) or as a basis to characterize process integration within the enterprises (Grüninger, 2000). In these cases, ontologies provide a complete, precise and shared terminology about a particular domain which facilitates integration and which will be easily reusable by the same or another organization. These advantages provide a considerable saving of time and effort in processes and data definition tasks, or in merging methods when similar representations about the same domain exist.

Using the previous ideas, our model proposes the application of ontologies for the representation of management processes defined in workflows and case data which are managed by workflow tasks. Although several consolidated models and languages of workflow representation exist (WfMC, 2005) (Van der Aalst,

² <http://www.w3.org/2004/OWL/>

³ <http://protege.stanford.edu/>

2005) (Alves, 2006), the application of ontologies in this field, used directly or as a definition of a metalanguage, can provide the following advantages:

- Case data managed by tasks can be exchanged without the need to carry out any modification in the definition of tasks. The taxonomies represented in ontologies, together with the attributes and relationships, are modular elements which can be modified if it changes the domain specifications. This implies that, if a task manages some case data represented in an ontology, and if the ontology changes, for example, adding a new subclass, modifying a particular attribute or the values of the attributes, the workflow definition need not be modified. Furthermore, as long as the superclass which links with the task is respected, and in order to deal with a similar workflow but with different case data, a new hierarchy of concepts can be added without the user having to carry out any additional process.

- Definitions of workflow processes, represented in ontologies, are easily reusable. By following ontology development methodologies, you can get complete, precise and consensus process definitions. This implies that workflow specifications would be more reusable and, also, if workflow integration processes of similar domains are necessary, these processes would be less costly.

3.2 Model Overview

The model presented in this paper proposes the use of ontologies to define and manage processes. These problems it deals with refer to management processes where different kinds of users adding information in each one of the defined tasks in the workflow. They are management processes that do not require the execution of external applications nor modules that carry out computational operations. Basically, the model proposes how the supervisor user must define the workflow with the tasks that a management process comprises, what information is needed to go from one task to another, and which kind of users are responsible of add these information.

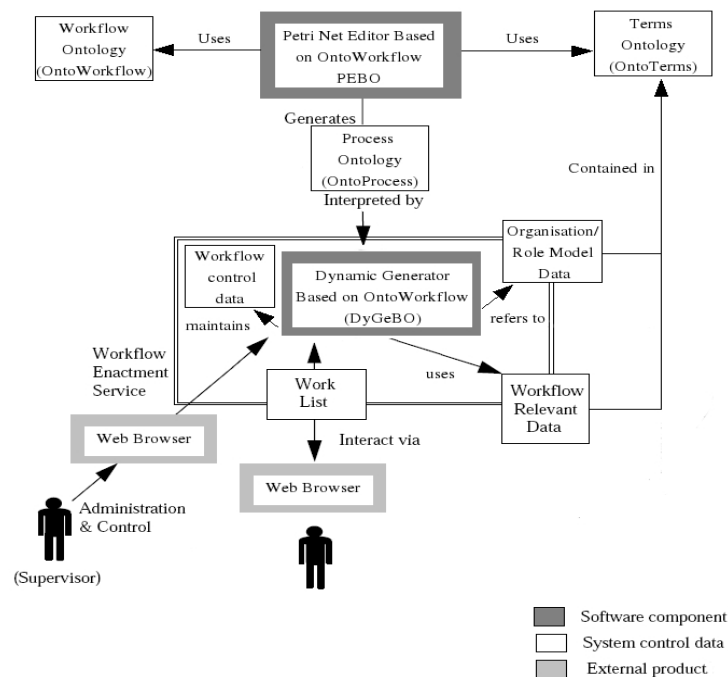


Figure 1. Overview of the proposed model

As already mentioned, the model proposes the use of ontologies to define process tasks, the taxonomy of case data transmitted from one task to another, and the taxonomy of users which may add new information. This ensures that the processes are well defined and are more reusable and, in addition, the classes of case data involved and the classes of users related with the tasks can be modified without changing the representation of the workflow process. Moreover, it should be noted that the taxonomies of classes and instances that may be needed as case data, can be defined in ontologies in the organization itself or can be

reuse from ontology repositories. If we use a domestic incident management workflow as an example, which needs, among other case data, “types of hardware and software components”, the workflow designer could reuse an existing ontology on that domain, with a consequent saving of time.

The proposed solution presents a series of components that form the architecture of the model (see Figure 1). Our approach provides an ontology as the basis of workflow representation, together with methods to identify and exploit the workflows of a management process and their respective software tools. The elements that constitute the model are:

1) an ontology of workflows (OntoWorkflow⁴, see Figure 2), based on the recommendations of WfMC, which models the elements that compose the administrative management processes and their relationships. OntoWorkflow serves as a framework for defining the terms involved in the business process and the processes that compose it. This ontology is built using the definitions of workflow elements provided by the WfMC as knowledge source. It has been developed following METHONTOLOGY methodology (Fernández-López, 1999) and it is represented using OWL Language⁵.

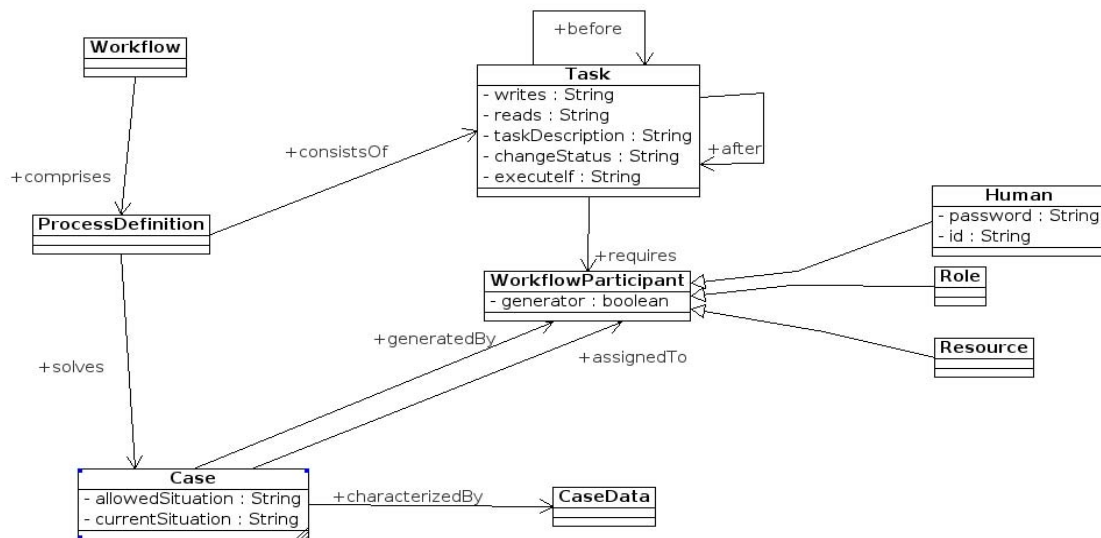


Figure 2. UML Diagram with main classes, relationships and properties of OntoWorkflow

2) a method to obtain the ontology of terms (OntoTerms) that consist of the elements to be used as case data and users of the business process which will be managed and which will be built following the specifications of OntoWorkflow. The root elements of this ontology are linked with superclasses defined in OntoWorkflow ontology. That is, each element defined in the domain will be a subclass of corresponding elements defined in OntoWorkflow. The development of this ontology can be done with any application that allows ontologies in OWL to be modeled, like Protégé. An example of ontology of terms for incident management based on ITIL⁶ is available⁷.

3) a method to build the ontology of the process (OntoProcess). Using the specifications of elements and relationships of OntoWorkflow, and the terms and users of the domain of OntoTerms, the processes of the business model are represented in OntoProcess. The order of execution of tasks, the elements of the ontology of terms to be shown, the elements to be added or modified and what participants intervene in each task will be represented in this ontology. An implementation of this method, called PEBO (PetriNet Editor Based on OntoWorkflow), is also provided. PEBO facilitates the representation of processes in an ontology of process using OntoWorkflow, OntoTerms and Petri net. An example of ontology of process for incident management based on ITIL is available⁸.

⁴ <http://quercusseg.unex.es/ontoquercus/?download=OntoWorkflow.owl>

⁵ <http://www.w3.org/2004/OWL>

⁶ <http://www.itil-officialsite.com/>

⁷ http://quercusseg.unex.es/ontoquercus/?download=OntoTIC_Demo.owl

⁸ http://quercusseg.unex.es/ontoquercus/?download=OntoTIC_ITIL_Demo.owl

DyGeBO Main Application: OntoTIC - Mozilla Firefox

Username: hardwareSupport01 Exit

OntoTIC Print this page...

Accessing instance TC5338069215...

Current task ID: 'ResolutionAndRecovery'
Description: 'Resolve the Incident using the solution/Work-around or, alternatively, to raise an RFC (including a check for resolution) take recovery actions.'

assignedTo	softwareManager01
descriptionOfSymptoms	Boot failure
startingDate	2008-09-01
startingHour	12:00

* For adding new values to properties, double-clicking on 'permitted values'.
 * For removing assigned values in properties, double-clicking on 'assigned values'.

Monitor	Permitted values: Philips01 Philips02 FujitsuSiemens01 Philips03 FujitsuSiemens02 Philips04	Assigned values:
Workstation	Permitted values: HPC3400_06 HP4400_09	Assigned values: HP4400_10

Figure 3. DyGeBO snapshot with an incident management example

4) a web application called DyGeBO (Dynamic Generator of WfMS based on OntoWorkflow) is the workflow management system provided by our model. DyGeBo manages the administrative process represented in the previously mentioned ontologies built using elements and rules defined in OntoWorkflow, i.e. OntoTerms and OntoProcess. The main feature of DyGeBO is that if at any time there is a change in the business process, both in the data elements and in the number or order of the tasks to be performed, DyGeBO is able to rebuild the entire workflow management system without affecting the user. That is, it is possible to change OntoProcess, which defines the process, or OntoTerms, which contains the information shown or needed to carry out in every task, and said changes are dynamically applied by DyGeBO. Figure 3 shows DyGeBO tool in incident management example.

4. CONCLUSIONS

The workflows have usually been used to define and manage business process models, where company or institution managers define these processes from scratch or reusing other similar models from their organization. There are business processes related to administrative management that do not need computational calculations or invocation of external applications; tasks consist only in providing information by the corresponding users from one task to another. For these processes, in which the weight of the system lies in the classification of the managed data in the tasks, and the categorization of the participant users for each task, the application of ontologies is highly recommendable because the properties of this type of knowledge representation are ease of use, comprehensiveness, consistency and shared information.

In addition to the above characteristics, the use of ontologies for the representation of workflow processes, promote the reuse, adaptation and integration of the processes. For integration in the field of ontologies there are many methods and tools that facilitate the unification of several ontologies of the same domain (Noy, 2004). These methods can be applied to the unification of workflow processes when they are represented with ontologies. Thus, when one or more organizations have two representations of similar workflows on the same business process, if they are represented with ontologies, they will be more easily merged.

To incorporate the advantages of using ontologies in the field of workflows, this paper describes how to make the representation both of processes workflows and the case data and users involved in the tasks, using ontologies. The elements and rules that define workflows according to the standards and recommendations of the WfMC, are specified in an ontology in the domain of workflows, called OntoWorkflow.

Based on this ontology, the methods for defining a business process model are defined with representation in ontologies. These are called OntoProcess ontologies. We have implemented a software tool

PEBO (PetriNet Editor Based-on OntoWorkflow) to define workflows with the elements and restrictions described in OntoWorkflow. PEBO, using Petri nets, allows users to define intuitively the execution sequence of their business process, data that should appear in every phase, and users responsible for filling in the corresponding information. PEBO allows the user to select this case data and designs these responsible users for the task from ontologies of terms, called OntoTerms. As mentioned, PEBO uses three ontologies to define workflows, but this is transparent to the user responsible for defining workflows, since the interface simply shows the design of the petri nets with the task sequences and allows the user to choose what information should be shown and what needs to be completed in each task, apart from the users who can perform them.

The processes represented following this model, are not only useful for organizing a company's workflows, but allow them to be executed directly by dynamic Web tools. Thus, the model provides a method that determines the steps and rules that should be followed in order to use the workflows directly in Web applications. That is, this method allows the workflows represented in OntoProcess and OntoTerms ontologies to be exploited, using dynamically generated web forms. Based on the proposed method the DyGeBO software tool (Dynamic Generator Based-on OntoWorkflow) has been implemented. DyGeBO generates web forms depending on the case state, the information to be shown according to the task specification, the information to be added, and the user to perform it. At present, this model has been used by the computer services company MPG Extremadura⁹ in the domain of information technology in a project of incident management based on ITIL.

The definition, merging and reusing of case data from workflows represented in ontologies are relatively simple processes with existing ontology software tools. In contrast, although the ontology merging methodologies can be extrapolated to the processes of workflows represented in ontologies, works have not been found in this field and, therefore, will be a future line of the work presented here. On the other hand, the implementation of transformation modules will be developed from business models (represented in language standards for representation of workflows) to ontologies. In this way, methods of reuse and merging of ontologies could be used applied to existing business processes that are currently represented in standard workflow languages.

ACKNOWLEDGEMENT

This work has been developed under support of CICYT under contract TIN2008-02985 and Junta de Extremadura Project (PDT08A023).

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⁹ <http://www.mpgex.es>

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E-AUCTION WITH THAI RICE EXPORT

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ABSTRACT

The purpose of this research is to analyze and design the suitable e-auction for Thai rice export which will create the fair price to both buyers and sellers. This research applies qualitative research by using depth interview to answer five research questions: (1) What type of e-auction is suitable for Thai rice export? (2) How can that suitable e-auction create trust between buyers and sellers? (3) How can the suitable e-auction make the e-auction operation auditability? (4) How can the suitable e-auction make bidding price to be dynamic pricing? and (5) How can the suitable e-auction create the fair price to both buyers and sellers? The result of this research indicates that the suitable e-auction for Thai rice export which will create win-win advantages for both buyers and sellers are English auction with reserve price. This type of e-auction displays information about the reserve price and the best bids price but does not show the name of bidder. In addition, all bidders must register into e-auction and open L/C before buyers are allowed by sellers to access to the e-auction system. The e-auction uses real time with limit period of time for bidding.

KEYWORDS

e-Auction, online auction, fair price, rice export.

1. INTRODUCTION

Thailand is one of the countries exporting rice to many countries in the world. Thai rice has a largest market share in the world for two decades. Recently, the amount of Thai exported rice decreased from 30% to 26.3% while the market share of Vietnam rice increased from 7% to 14%. The export volumes of Vietnam have been continuously increased since 2004. The important factor influencing to decrease demand on Thai rice is that Vietnam uses low price strategy to attract the buyers. Vietnam has developed and improved the quality of rice to meet the setting rice standard from many importers. In addition, many Thai rice exporters keep reducing the prices of rice due to importers always buy rice which is lowest price from exporters. The above situations make the price of Thai rice is continually decreased which is not aligned with the quality of rice. Therefore, many Thai exporters try to find other channels to sell their rice. The online auction or e-auction is considered possible solution to be used. It is believed that online auction will create the fair price with the acceptance between buyers and sellers. In addition, it can help to reveal the real value of rice and make reasonable rice's price compared with rice's quality. Moreover, Exporters can create bargaining power in trading by offering bids via online auction.

2. PRIOR RESEARCH

From previous study on exporting rice and online auction, there are two important factors initiate the auction process: (1) setting suitable reserve price by sellers and (2) entering into bidding process of buyers. The following sections discuss these factors in details.

2.1 Setting Suitable Reserve Price by Sellers

Reserve price means lowest price of rice that sellers will receive from selling rice. In online auction, the sellers always use an online auction with reserve price in order to guarantee their minimum profit from bidding. If reserve price is suitable, this price will increase number of bidders entering into online auction

and may enhance final bidding value. Apart from suitable reserve price, the buyers also need information about products in order to make decision to stop or continue offer-bidding price to be winner. (Tucker, J. and Massad, V., 2003). To set reserve price, the sellers must set reserve price nearly or lower real value of product in order to motivate the buyers more than setting reserve price higher which has risk to lose selling. If the sellers set reserve price nearly real value of product, the sellers may be able to sell high goods price (Guo, X., 2002). By setting the suitable price, both sellers and buyers can get the best price and affect to success in online auction (Niraj, R. et al, 2001). The case of AuctionAnything.com showed that suitably high price setting should have the effect on increasing bidder participation at higher bid levels, while eBay.com showed differently. The eBay.com showed that high price setting should have the effect on increasing bidder but cannot make real bidding. Price offered will happen when open auction is lower price (Suter, T. and Hardesty, D., 2005). The important cause that some online auctions have no participation trading is some buyers stated that the online auction with reserve price take profit of sellers. In fact, the operating process and profit of e-auction depend on bidding by buyers that makes the sellers set the reserve price for the auction in order to reduce the risks. From the case study, English auction without reserve price can increase profits to the sellers same as English auction with reserve price. So, the sellers are not necessary to defraud by setting reserve price (Budish, E. and Takeyana, L., 2001).

2.2 Entering into Bidding Process of Buyers

The most important factors that affects customer behavior is the reserve price and rule in online auction defined by the sellers. The low price setting affects increasing the number of bidder but cannot motivate to bidding. The buyers bidding based on two factors: (1) knowledge about product for the auction and (2) strategy in auction (Ariely, D. and Simonson, I., 2003). Refer to statistical number, 60% of buyers have behavior in Patient bidding (to endure in bidding) and Analytic bidding (analyzed when offering) and 39.3% of buyers have behavior in Impulsive bidding (immediately bidding). The main problems of buyers are that the buyers are not able to predict the seller's behavior in accepting price level. Buyers cannot estimate because online auction market just uses User ID and nickname that is the obstacle to acknowledge information (Chan, C., 2005). In addition, Strecker, S. and Seifert, S. (2004) state that the bidders may have no experiences or they may be new bidders in auction and lack of knowledge about product or new product in market. All of these conditions affect to make decision on continued bidding (Mehta, K. and Lee, B., 1998). By the way, the negotiation process will start when the sellers offer product in online auction market. Buyers consider whether the offer price is suitable or not. If the price is not acceptable, the buyers will negotiate to the sellers. The accepted order will be committed when the negotiation finished. (Strobel, M., 2000)

3. MODEL AND RESEARCH QUESTIONS

Previous researches on online auction have shown that the most important factors for Thai rice export which will create the fair price and the acceptance between buyers and sellers are (1) type of online auction with reserve price (E-auction), (2) trustworthiness of online auction process (Trust), (3) transparency in auction (No collusion), (4) level of e-auction price (Dynamic Pricing) and (5) price in auction (Fair Price). These factors can be grouped into 4 phases as shown in figure 1.

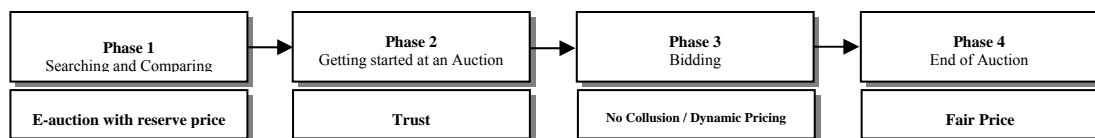


Figure 1. E-auction process for Thai rice export

Each phase involves various processes, which lead to gain an acceptable fair price by both Thai rice exporters and foreign rice importers. There are 3 principles in considering the fair price: (1) price calculated from the relation between price and cost (2) price calculated from demand and supply and (3) demand and response create the general price that is higher than cost. The following sections provide detail about fair

online auction of rice. To reach fairness, the exporters have to make decision on appropriate factors involved in each phase indicated as follows.

3.1 Phase 1 Searching and Comparing

In this phase, the exporters have to make decision on what type of online auction is suitable for Thai rice e-auction. E-auction with reserve price factor is studied in this phase. This research posits that the exporters will use Auction theory and Risk theory as basis for choosing items in each factor. Apart from using those theories, Thai exporters analyze and compare online auction with rice exporting processes in traditional. Figure 2 shows the choice of decision making in each item of phase 1.

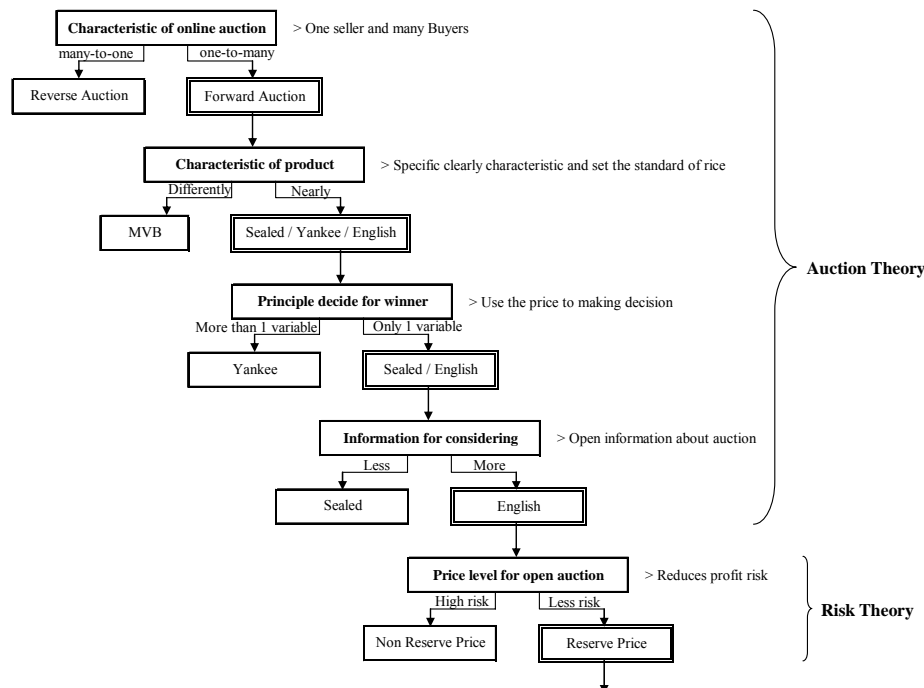


Figure 2. Phase 1: Searching and Comparing

3.1.1 Characteristic of Online Auction

The first step in phase 1 that exporters have to choose is which types of online auctions they have to use for rice auction. The online auction generally has two characters including Forward auction and Reverse auction. Forward auction is suitable for market with one seller and many buyers while Reverse auction is suitable for market with many sellers and one buyer. Since rice trading market is one seller and many buyers, Forward auction is appropriate for rice trading market. Moreover, auction theory states that buyers trying to offer the best price in bidding in order to be winner. This behavior will affect the price level. The price level will be continually increased until the best price is reached by one bidder. The bidder who offers the highest price will be the winner. Normally, sellers want to get profit as much as possible from selling. If many bidders try to compete with other by offering best price, the sellers will gain more profit. Forward auction has characteristics which enhance sellers to earn more profit from selling rice. For Reverse auction, it is mostly used in procurement auction. This auction will start at high price and the bidders reduce the price level. The person who offers the lowest price in the auction is the winner. Therefore, the suitable characteristic is Forward auction because the sellers want to gain the profit from selling rice.

3.1.2 Characteristic of Product

The second step in phase 1 is to choose online auction among the four types of auction: MVB, Sealed, Yankee, and English auction. The criterion used to select these types of auctions is based on characteristic of

product for bidding. For world rice trading, the quality of rice has been clearly set up. The rice quality is classified into (1) high quality rice (jasmine rice and white rice 5%-100%) (2) normal quality rice (white rice 10-15% and glutinous rice 10%) (3) low quality rice (white rice 25% and broken rice). Auction theory states that if the buyers are confident in the quality of products sold in online auction, they will use price as criteria in making decision. Thus, the suitable characteristics of rice auction are Sealed-bid, Yankee and English auction. MVB auction is suitable for product with different quality. The buyers will use more than one factor in making decision. Normally, the buyers will use PPP (Price per performance) or product performance score for decision making.

3.1.3 Principle Decide for Winner

The third step in phase 1 is to choose the auction among the selected auction from section 3.1.2: Sealed, Yankee, and English auction. In this step, sellers will use the highest amount of money got from auction. This criterion is confirmed by Auction theory. The Auction theory states that product in competitive market is strongly needed from buyers and many buyers want to bidding in order to be only one winner. Especially, rice is necessary consumer goods and country buyers cannot produce rice. This means that many buyers will try to increase the bidding price in order to be the winner. The volume of rice trading from business to business (B2B) is higher than business to customer (B2C). Therefore, the suitable auctions are Sealed-bid and English auctions. Yankee auction, however, will allow the bidders offer the same price. These Yankee auction also want the winner more than one because there is a lot of volume more than one buyer can buy.

3.1.4 Information for Considering

The fourth step in phase 1 is to choose between the two auctions in section 3.1.3. The sellers have to make decision on revealing information during the bidding process. Information for considering means the sellers ability to display information during auction such as reserve price, number of bidder and the best price level. The buyers can use this information to define strategy for offering bidding. Auction theory states that the above character is Open auction like English auction. This information can be used to create motivation buyers for bidding. For Sealed-bid auction, buyers know only his/her bidding but they don't know others bidder which makes buyers difficult to make decision.

3.1.5 Price Level for Open Auction

The final step in phase 1 is to initiate the suitable reserve price. This price is necessary to motivate buyers to participate in bidding. If the reserve price is too low, the sellers may not be able to gain profit from auction. They may not accept and cancel the auction. In the meantime, if the reserve price is too high, there are no buyers entering into bidding process. Risk theory, sometimes called economic risk, suggests that risk can be controlled and managed by statistic analysis. For the above situation, the sellers need some approach in reducing the risk to least level. The approach that most sellers use is to set reserve price. This price will guarantee the minimum benefit to sellers. Therefore, the final bidding price (higher than or equal to the reserve price), the sellers do not worry because the price is over the profit margin. Therefore, the sellers should set the suitable reserve price in order to minimize the risk of getting loss from auction.

3.2 Phase 2 Getting Started at an Auction

This phase involves selecting the sellers and buyers to participate in online auction. The concerned factors in this phase are trust and acceptance (as shown in figure 3). As online auction is a free trade, sellers have to authenticate the buyers. They have to make sure that the winner (buyers who win the auction) will pay for the auction products. Meanwhile, the buyers want to make sure that they will receive the products based on offered quality on auction. For this phase, sellers use imperfect information theory, asymmetric information theory, and market equilibrium theory on the basis of suitable rice auction.

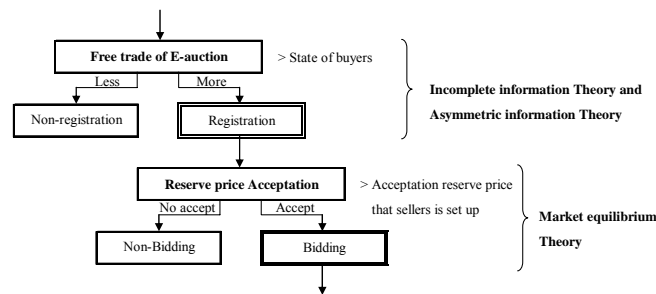


Figure 3. Phase 2: Getting started at an auction

3.2.1 Free Trade of E-Auction

The first step in phase 2 is to authenticate both sellers and buyers. Online market is free trade. The Incomplete information and Asymmetric information theory states that both buyers and sellers may have completed information of each other's. They want to make sure that their parties are real people. For online auction, the big Thai exporters may not have information of new buyers who just enter the auction process. In order to authenticate their customers, sellers should collect new buyers' information with registration via login.

3.2.2 Reserve Price Acceptation

Apart from authentication, the final step in phase 2 is to motivate buyers to participate in online auction. Sellers can motivate the participants by setting an appropriate reserve price. Market equilibrium theory states that demand and supply depend on price. Therefore, buyers' volume and sellers' volume will be adjusted when price is changed. Sellers should set the reserve price by cost and benefit. This price will lead buyers to negotiate the rice price. If buyers find that the starting price of sellers is acceptable, buyers will start bidding. On the other hand, they may do differently if the starting price is unacceptable.

3.3 Phase 3 Bidding

This phase is to study buyers' behavior in making bidding by managing no collusion and dynamic pricing factor. Game theory is used as the basis for an argument. This theory posits that real time offering, no collusion bidding and increasing of price level lead to the highest profit. Figure 4 shows the bidding process.

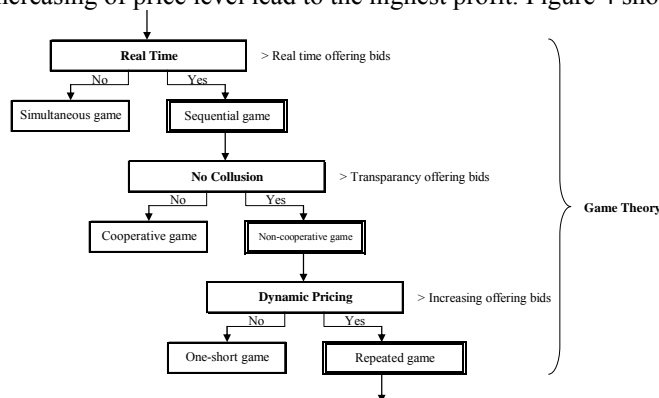


Figure 4. Phase 3: Bidding

3.3.1 Real Time

The first step in phase 3 is real time bidding. Normally, the final objective of selling products is to earn highest profit. Game theory states that the bidding has two formats: Simultaneous and Sequential game. For Simultaneous game, the final price is the fixed price. Most buyers will know other bidders' prices at the end of bidding. It is not dynamic price. Thus, this type of game is not suitable for Thai rice export. However, in the Sequential game, the bidders know the highest bidding price during bidding process. Therefore, the

bidders who want to get the products will adjust their strategy by offering higher prices that will also affect the price of other bidder. In addition, the Game theory also states that real time offering provide dynamic price to seller and buyers until the bidding process finished.

3.3.2 No Collusion

The second step in phase 3 is no collusion. During the bidding process, all bidders do not want any other bidders to make agreement behind the bidding process. In general, there is risk about collusion during auction such as the collusion among buyers. The Game theory states that the collusion occurs if the auction has a few bidders. These bidders can negotiate to share profit, which is called Cooperative game. For real time auction with lots of buyers, communication among buyers will be obstructive. In addition, the Game theory states that the lack of communication and information impedes collusion. Thus, the Non-cooperative game is most suitable for rice trading.

3.3.3 Dynamic Pricing

As stated in section 3.3.1, the final objective of selling rice is to earn highest profit. The Game theory predicts that buyers will increase rice price once they know other foreign importers' behavior in price bidding. In real time bidding, all bidders can get other bidders' private price in the offering report but can not know the name of bidders. Thus, the buyers who want to be a winner have to adjust their private value as new information getting from the auction. This leads to final step in phase 3. For this phase, the sellers have to select the type of the game between One-shot and Repeated game. In the One-shot game, the buyers can offer bid just one time only. The buyers cannot change their offers. In the Repeated game, buyers can offer bid more than one time until the bidding time is finished. Many buyers will try to offer the best bids to be a winner. This offer bid reflects true value of product. Thus, the sellers and the buyers receive highest profit from the auction.

3.4 Phase 4 End of auction

This phase is the result of final bidding. The objective of final bidding is to get the fair price. The fair price is the acceptant price between sellers and buyers. The Game theory states there are two games considering for fair price: Zero-sum and Positive-sum game.

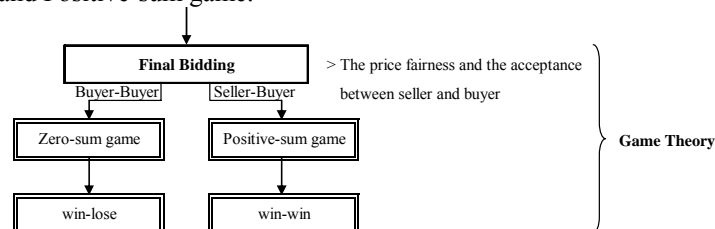


Figure 5. Phase 4: End of auction

3.4.1 Positive-sum Game

The game that all players get the advantage together is called win-win. This means that both the sellers and buyers receive their required benefits. The sellers' gets highest profit from selling rice while buyers gets the high quality rice with an acceptable price.

3.4.2 Zero-sum Game

The game that one side player gets advantage and another side player loses advantage called win-lose. As there is one product, only one winner will get the product. Therefore, the seller has to accept price offered by the buyers.

The above e-auction process for Thai rice exporter posits five research questions: (1) What type of e-auction is suitable for Thai rice export? (2) How can that suitable e-auction create trust between buyers and sellers? (3) How can the suitable e-auction make the e-auction operation auditability? (4) How can the suitable e-auction make bidding price to be dynamic pricing? and (5) How can the suitable e-auction create the fair price to both buyers and sellers?

4. METHODOLOGY

To investigate the research questions, this research is based on qualitative research to collect evidence. The research was carried out with seven vice presidents from Thai rice exporter and twenty foreign rice importers. Researcher performed the interviews with seven vice presidents. Approximately 60-90 minutes were spending on each interview. For twenty foreign rice importers, data was collected via questionnaire because it is inconvenient to interview via telephone or web. The contents of interview and questionnaire are the same, were transcribed, analyzed and saved as a written manuscript (approximately 90 pages) in order to be qualitatively analyzed by the researcher.

5. ANALYSES AND INTERPRETATION

The data collected from participants were analyzed and interpreted within the context of five factors: e-auction with reserve price, trust, no collusion, dynamic pricing, and fair price. The following sections present the analysis and interpretation for the five factors.

5.1 E-auction with Reserve Price

Most participants agree that Forward auction with the highest bid is an appropriated online action for Thai rice export. Some participants claimed the following statements.

“Rice auction should follow eBay.com pattern that whoever offer the highest price will win because exporters will satisfy high profit.”

“Online auction that is suitable for Thai rice export is the auction which considers the winner who offer the highest bid.”

Most exporters give special importance to rice price offered on bidding. They concern only the bid price which they can accept. On the other hand, the importers consider not only the rice price (83% of participants) but also the rice quality (93% of participants). The importers also mention that they always compare rice price from various exporters before starting the buying process. Therefore, English auction which is open auction (as posited in the model on section 3) is acceptable. This auction requires the exporters to reveal starting price and the best offering bid during auction. Therefore, the importers can make decision whether to start bidding.

Apart from price and disclosure of information, 96% of importers also concern about trustworthy and readiness of exporters. They want to have more information on product before auction processing, exporters' information, and auction methodology. However, they want to hide their name during the auction processing because their competitor should not know who offering price as shown by the following statements.

“Exporters have to be careful not to reveal importers' name and their final price on rice. Most buyers do not want their competitors know how much the agreement of the rice price?”

Due to the rice price is unstable, exporters need to define the reserve price in order to reduce risk from canceling the auction when the final price can not generate the profit for exporters. Defining the reserve price affect to accept and make the decision for attending the bidding. The following statements confirm the above analysis.

“A reserve price is real price that will be selling”.

“An importers will not enter bidding that has a reserve price that is too high and return to buy at normal trading.”

5.2 Trust

Most participants agree that they do not need information of each others if they have used to deal business together because they have sufficient information to make decision. For new exporters or importers who had never known each other before, either exporter or importers has to prove their identity. Moreover, participants agree with online register system and open L/C document in order to confirm financial stability of importers. In addition, all importers also want exporters to guarantee on the quality of auction products.

The importers who never trading can assure risk from exporters if the deliver of product is delayed or is not the same quality as specified at online auction, the importers can claim exporters by used L/C document. The following statements confirm the above analysis.

“The register system additional document may be required in order to confirm the appearance.”

“Register system in online auction can help checking buyers before allow them to bid which reduces deadblack bidder problem.”

5.3 No Collusion

Seventy nine percent of importers agree that online auction can be reduced collusion. Online auction hides the name of importers who enter bidding. Hiding name of bidders do not allow one bidder to contact with other bidder in order to avoid dishonest bidding. Furthermore, online auction defines a short period of time for bidding such as one hour which is too short for bidders to negotiate for collusion. The following statements confirm the above analysis.

“I am not worry about either real time or posting but in fact real time is hard for management. For example selling Thai Hom Mali rice are for consumers in Hong Kong, Singapore, Europe and Africa, you cannot set a short period of time for e-auction such as 2 hours. Some countries may not wake up while in some countries will be bidding.”

“If online auction is not real time offering characteristic, it will be able to be a collusion between buyers. On the other hand, if online auction is real time characteristic it will be able to increase difficultly communication.”

However, some exporters state that it is hard for exporters and importers in rice markets to make secret cooperate agreement. The rice market is large with many exporters and importers. So it is hard to find someone to do something dishonest as shown by the following statements.

“Because the rice market is an industry that does not have only one importer but there are many importers and exporters in the rice market, opportunity to make collusion is hard.”

5.4 Dynamic Pricing

Eighty six percent of importers agree with using dynamic price by allowing bidders to offer price more than one time. The importers can adjust their strategy by offering higher price if they find the bidding price is suitable. They, however, will stop offering the bidding price if the bidding price is too high. The following statements confirm the above analysis.

“Before the importers make decision to offer bidding, they calculate that this price can make profit or benefit in self-market. If it can not make profit they will not offer bids with other importers.”

“There are two factors in offering bid of importers: (1) self-motivate of importers and (2) the level price that importers think it is suitable.”

“The offering bids that can offer one more time under period time in auction effect to increase suitable price level.”

5.5 Fair Price

Seventy three percent of importers agree that online auction creates fair price and make win-win for both exporters and importers. Although, the final price is lower than expected, the exporters can accept. The exporters can get profit from e-auction which the reserve price is defined. The importers also accept this price because they get the quality rice with acceptable price. The following statements support the above analysis.

“The online auction creates win-win because we have reserve price and importers can accept it. If they feel that price is not suitable, they will not offer-bidding.”

“Online auction can create fair price and profit for both exporters and importers like win-win.”

6. CONCLUSION AND SUGGESTIONS FOR FUTURE RESEARCH

The type of online auction which is suitable to Thai rice export is English auction with reserve price. This auction create fair price and can be accepted by exporters and importers. In English auction with reserve price, the highest bid wins. This auction reveals information of reserve price and the best price bidding but not show the bidder name. However, all bidders must register into e-auction and open L/C document before importers are allowed by exporters to access to the e-auction system. The bidding use operate in real time with limit period of time. Moreover, the rice exporters should consider using online bidding when the demand for rice is higher than supply. For normal situation, rice exporters should use normal channel because rice market is based on importers.

This research is a single case study. The rice exporters have never implemented this online auction. The collected data reveal only the opinion and experience on other commercial online auction (i.e., eBay.com) of exporters and importers. The online auction has never been used in practice. Therefore, Thai rice exporters who want to implement this auction should consider the situation of world rice market.

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ARE SOFTWARE PROCESSES BUSINESS PROCESSES IN E-BUSINESS CONTEXT?

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ABSTRACT

During these years tons of modeling languages have appeared as solutions for describing business domains. Domain complexity is one of the cornerstones and the main reason for this diversity. Processes are inherent elements inside our daily tasks. In the IT domain, software and business are very tightly related and we can point out a hint of processes behind them. Several authors have argued in the past that software processes are business processes too (Boyd, 1994) (Henderson, 1994). However due to the evolution of languages, there are some differences from the execution point of view. This paper provides a rationale about their similarities and differences, and a rationale about when a language should be used instead of the other within the e-business context.

KEYWORDS

Modelling, software processes, business processes.

1. INTRODUCTION

Since the OMG's Model Driven Architecture® (MDA, 2001) standard specification, a new gold fever in the software engineering has resulted in the development of hundred metamodels for hundred domains. This fact can be seen and checked in the number of OMG's standards that have been released and have been proposed during these recent years. This situation has as a main consequence that people mind is more focused on the generation of metamodels as metamodel factories and they put aside unresolved conceptual issues.

In the software process definition arena two proposals seems to fight a duel for its adoption in the market. These key players are the ISO 24744 (ISO24744) and SPEM 2.0 (Software Process Engineering Metamodel). These two proposals are clearly different from a metamodeling point of view. SPEM2.0 is compliant with the OMG's four meta layers that is our Reference Metamodeling Architecture (RMA). ISO24744 is based on powertype patterns and clabjects, metamodeling concepts different from RMA. This RMA is known as the strict metamodeling approach and it is being promoted by the OMG and most of the tool vendors.

In the business process domain and taking into account our RMA there is a set of initiatives focused on solutions for designing (BPMN), (BPDm) and assessing business processes (BPMM). BPDm represents a MOF based metamodel and it is tightly related to BPMN being the reference notation for business processes. All these initiatives are being developed by the industry investing work and money.

Based on this situation there are two reference languages which notations are used for describing processes: SPEM and BPMN.

There are several definitions for the e-Business concept but a generally and a user friendly definition is the following:

E-business (electronic business), derived from such terms as "e-mail" and "e-commerce," is the conduct of business on the Internet¹

Therefore it seems to be clear that organizations based on the Internet are related to the information technologies and its development. In order to improve their organizations they are adopting process improvement initiatives requiring a definition of their internal processes.

¹ http://searchcio.techtarget.com/sDefinition/0,,sid182_gci212026,00.html#

However there is a dilemma within an e-Business context: what is the language that we need to use for our process definitions?

As result organisations are struggling with the uncertainty of the improvement initiatives before taking up their processes definition. In addition there is no common adoption on what is the suitable language for describing the organization's procedures.

This paper is structured as follows. First section explains some problems using BPMN and SPEM for describing a business scenario. The second section provides an overview of the execution and enactment concepts for these processes. The third section evaluates and compares BPMN versus SPEM. And the last section concludes this paper.

2. COMMON MISUSES OF PROCESSES

Process definition has been applied in several domains for different purposes such as industrial application (Fabbrini et al., 2004), interoperable software development domain (Larrucea, 2008), agile processes (Larrucea et al. 2007) and for business process definition (Zhao, 2005).

Apart from conceptual issues such as described in (Henderson-Sellers et al. 2005), practitioners are not aware and they do not care about the unresolved conceptual issues. They are more worried about which is the language they need to model their processes. Some practitioners state that software processes are a kind of business process but this statement implies that every software process can be represented (syntactically and semantically) with a business process. Other practitioners should even state that they can represent their software processes using business processes. Both situations arise from behavioral anti patterns² such as "golden hammer" or "silver bullet". People are always attracted by wrong behaviors guided or steered by wrong practices. It is true that there is some kind of similarities between business process modeling languages and software process modeling languages. However, it is not recommended to model software processes using a business process modeling tool and vice versa. For example the following Figure 1 represents a SAP business processes best practices Logistic planning (V5A)³

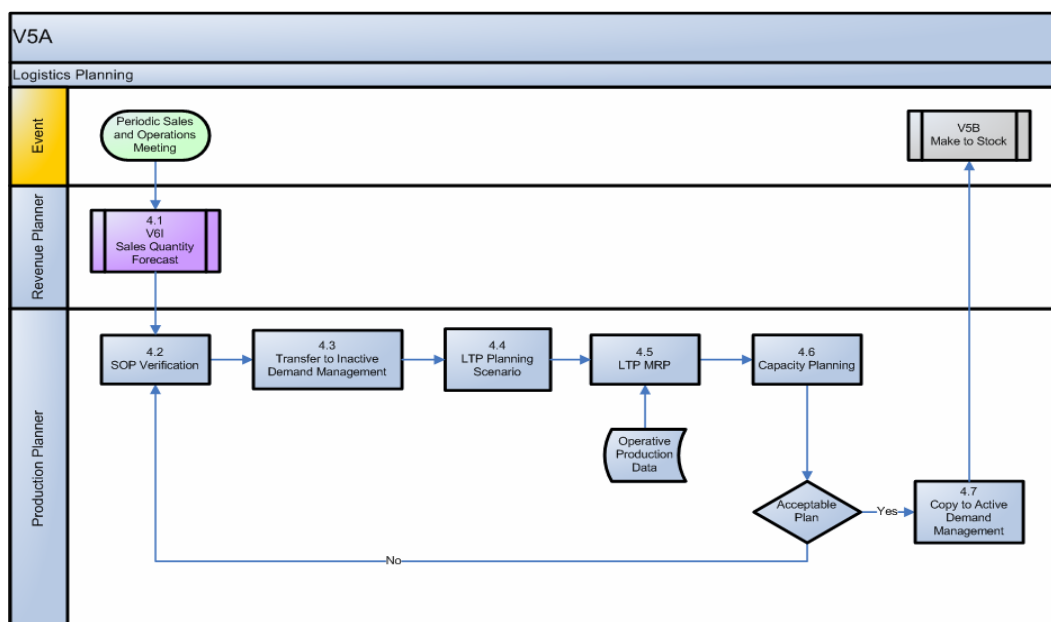


Figure 1. A Business Process Use Case Scenario

² <http://en.wikipedia.org/wiki/Anti-pattern>

³ http://help.sap.com/bp_blv1500/BL_US/documentation/Scenarios/V5A_BPP_EN_US.doc

This example is very representative of collaboration between entities and it introduces some concepts such as events, data, activities and flow. In this process there two roles: Revenue Planner and Production Planner. This process is executed or triggered after an event called “Periodic sales and operations meeting”. This example fits with some definitions for Business Processes such as:

*A business process specifies the potential execution order of operations from a collection of Web services, the data shared between these Web services, which partners are involved and how they are involved in the business process, joint exception handling for collections of Web services, and other issues involving how multiple services and organizations participate.*⁴

From this definition we conclude that business processes imply a kind of collaboration and the execution of some kind of software components with exceptions handling and so on.

This use case can be modeled using a software process modeling tool such as Eclipse Process Framework (EPF) (Figure 2). **Is this approach correct?**

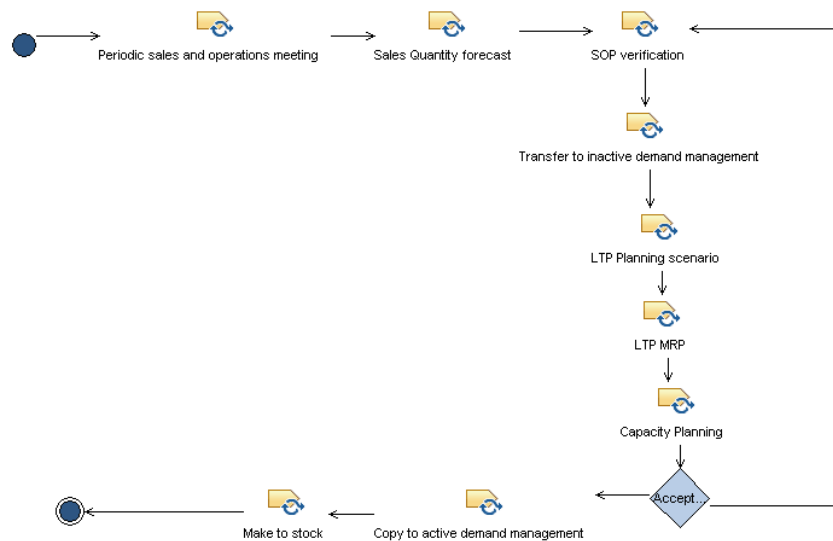


Figure 2. A Business Process Use Case Scenario using EPF

Figure 2 shows the same business described previously in Figure 1. Apparently both diagrams can be used for describing a business process. Internally each task descriptor is related to a set of role performers. However we are not using a right language for the right domain. Using SPEM2.0 we cannot distinguish among internal, public and global processes as it is defined in (BPMN). Moreover OMG’s SPEM2.0 standard specification states in (SPEM2.0):

An implementation of this meta-model would be targeted at process engineers, project leads, project and program managers who are responsible for maintaining and implementing processes for their development organizations or individual projects.

Therefore in this case all these activities are task descriptors related to development projects.

All these languages are created to achieve agreement among practitioners and mixing both worlds we confuse practitioners. Some concepts such as roles are apparently similar but there are others such as events, public/private/global processes that are more complicate to be modeled using SPEM2.0. The frontier between these two worlds is still blurry but the limit is defined during the execution and enactment process.

3. EXECUTION AND ENACTMENT PROCESS

There are differences between business processes and software processes from the execution and enactment point of view. In fact there is a fundamental divergence from the execution and enactment perspective.

⁴Business processes in a Web services world. Frank Leymann. Dieter Roller <http://www.ibm.com/developerworks/library/ws-bpelwp/>

For example on the one hand business process execution is related to the execution order of operations such as we mentioned before.

On the other hand software process enactment is a required characteristic when a standard software process (methodology) (Beth Chrissis, 2002) is going to be adopted for a specific project and need to be aligned with the specific requirements of the environment.

As we state previously our formal representation for processes is our RMA promoted by the OMG. However we need to clearly identify what enactment process we are going to use taking into account this reference architecture. This process is shown in Figure 3. As we are going to check there is a progressive divergence during the enactment processes. The enactment process starts from level L3 and goes to level L0. Business and software execution processes start with the same metamodel called MOF.

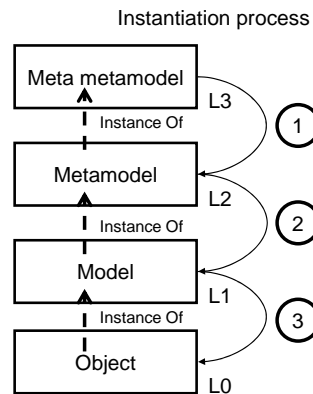


Figure 3. Instantiation process

Figure 4 represents the OMG's approach concerning the strict metamodeling (on the left), the approach used for software process modeling meta architectural levels (centre) and the business process execution meta architectural levels (on the right). The meta layers are illustrated with a related element at each level.

Meta Object Facility (MOF) is placed at level L3, and it represents the core meta-metamodel for OMG's standards. Software Process Engineering Metamodel (SPEM) is defined as an instance of MOF and it is located at level L2. BPMN can be also placed at this level because it is the reference notation for BPDM (BPDM). Level L2 represents a language definition. In our approach we have two reference languages: SPEM and BPMN/BPDM.

SPEM (center of this Figure 4) is used for defining software processes and methodologies that will be followed by organizations. BPDMN/BPDM (right side of this figure) it is used for defining business processes.

At level L1 we have user designs defined by stakeholders. On the one hand using SPEM, methodologies are defined at level L1 and using CMMI® (Mary Beth Chrissis) terminology this level represents the Standard Software Process (SSP). Once a set of SSP is defined, organizations need to tailor some SSPs for each specific project at level L0.

On the other hand using BPDM/BPMN the business behavior is defined at level L1. At this stage we have a first version of the architecture (at least functionalities provided by the business infrastructure).

The enactment process for business and software is shown in Figure 4.

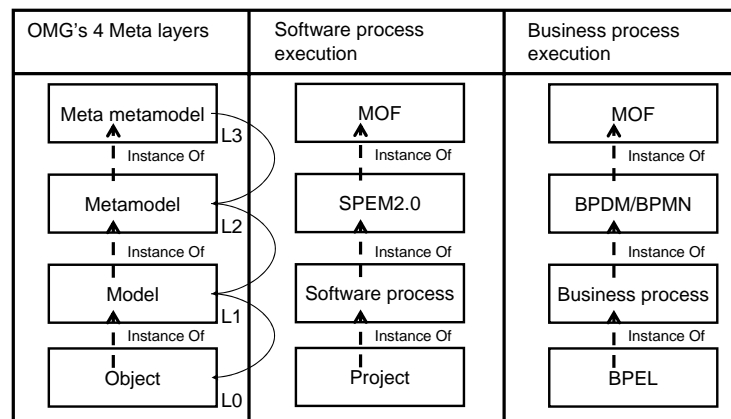


Figure 4. Strict metamodeling approach and software process metamodeling approach

The enactment process is a subject of several discussions. Concerning this area we formulate in this paper several questions: What does the enactment process means? How is it performed? How is it included in the strict metamodeling approach? These questions are answered as a whole in Figure 3 and Figure 4.

In our approach the enactment process for software processes is basically focused on the process to tailor a standard process into a specific project (Figure 5) with necessary data such as the project starting time, who is going to perform the roles defined in at the process level (L1), etc.

The enactment process for business processes it is related to the software architecture providing support to the business operations.

Both enactment processes are represented at the lower level of the meta layers (L1 and L0). The relationship with the strict metamodeling approach is shown on Figure 5 and it is surrounded with an ellipse.

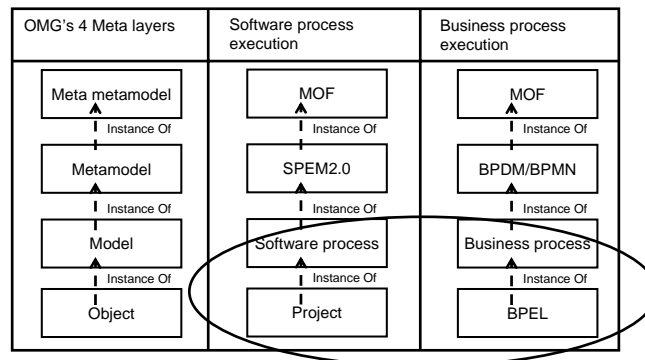


Figure 5. Business and software process enactment

At this stage the information needed for the enactment process is quite different. These requirements are gathered depending on its perspective (software or business):

From a software process perspective we need to identify:

→ Performers for each role defined in the SSP

→ Precise timeline for tasks

→ Task duration

→ Manage people and roles assignments: modeling people is a widely discussed concept because of its adequateness and because not all authors want to model this kind of elements. In our approach we consider that at level L1 a SSP is defined. Therefore at this level we model activities and roles for defining a process or a methodology for an organization. In addition not only roles and activities (mainly) are defined but also the people of the organization. If we want to model people to be included in the enactment process in a further step, we need a metamodel that it is placed at level L2 and specific workers are modeled at level L1. As we have stated the enactment process is focused on the instantiation between level L1 and L0 and basically it is based on the instantiation between L1 and L0.

→ Project plan generation for project tracking

From a business process perspective we need to:

- Identify the software components related to activities
- Identify available Web Services if we choose this kind of components
- Normally we do not need to set up task duration but it is very valuable
- Project plans are not generated
- Identification and clear separation between external and internal processes
- Computer based process execution environment such as ActiveBpel

4. BPMN VS SPEM

BPMN and SPEM need different requirements such as we mentioned in previous section. SPEM and BPMN differences go further than just business and software terminology differences. Once we have identified these requirements we need to evaluate which language we need to model our processes.

In this section we want to provide a roadmap for process modeling language usage. As we mentioned before we are going to use SPEM version 2.0 and BPMN version 1.2 for this evaluation. This roadmap is based on a set of possible situations for an organization.

Table 1 shows possible situations where it is recommended to use one language instead of the other. This evaluation is a result from several experiences in projects⁵⁶ and consultancy activities.

For each possible situation we mark with a cross the language used in our experiences. It is recommended that practitioners with scarce experience need to distinguish between the use of BPMN and SPEM. More specifically they need to proceed with the enactment process and check what possible situation gathered in Table 1 matches with their specific domain.

The limits between them are blurry and sometimes there are overlapping. Depending on the execution point of view we select the right language.

Table 1. Language selection decision support: BPMN vs. SPEM

Possible situations	BPMN	SPEM
Generate project plan		X
Specify standard software processes		X
Specify quality practices such as CMMI, ISO and ITIL processes		X
Define development processes		X
Generate a piece of code	X	X
Organisational's roles	X	X
Activity is related to an organization's activity	X	
Business Control flow	X	
Public/private/global process differentiation	X	
Computer/System behavioral specification	X	
Specify a coordination between components	X	
Implies a kind of transaction	X (most of the times)	
Implies the assistance of a software application	X	x
Connect components	X	
Software life cycle		X
Business Behavior	X	
Software Behavior	X	x
High level programmable language	X	

5. CONCLUSION

In this paper we have provided a vision for business and software process enactment in order to reduce the uncertainty of the improvement initiatives before taking up processes definition activities. During the

⁵ Modelplex project. European Project. IST <https://www.modelplex.org/>

⁶ Vulcano project. Funded by Ministry of Industry. Spain <http://www.ines.org.es/vulcano>

introduction section we have pointed out that there is no common adoption on how to know what language we need to model our processes. This selection implies a dilemma within an e-Business context: what is the language that we need to use for our process definitions?

The answer is depending on the enactment process. Section 3 describes the meaning for process enactment in both domains and it explains how it is performed. We introduce some requirements from execution and enactment point of view. Selecting the right language for the right domain reduces the uncertainty of the improvement initiatives before taking up their processes definition. Finally in this paper we provide a roadmap for identifying the right language for our domain and requirements.

Currently we are applying process modeling in two different domains:

-Business Processes: generation of service oriented architectures. We are generating not only Web Services from BPMN models but also SOA designs. This case is more suitable for an e-Business context to define their business processes using BPMN in order to ensure a right design of their applications.

-Software Processes: we are working on its integration with development forges such as SourceForge in order to facilitate collaboration in heterogeneous context and to help developers during their development process. This feature will help organization to achieve compliancy at CMMI levels 2 and 3 through the definition of defined and managed standard software processes.

ACKNOWLEDGEMENT

Vulcano project (Proyecto Singular Ministerio Industria, Turismo y Comercio- TSI-020301-200822).

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COMPARISON OF COMMUNITY IDENTIFICATION TECHNIQUES FOR TWO-MODE AFFILIATION NETWORKS USING WIKIPEDIA DATA

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ABSTRACT

One of the most important questions in social networks is the identification of cohesive subgroups (a.k.a. community identification). These cohesive subgroups are loosely defined as collection of individuals who interact frequently. Once the communities are identified they often reveal interesting properties of the social network members, such as common hobbies, interests, social bindings, occupations etc. Several types of algorithms exist for analysis and identification of cohesive subgroups in one-mode networks that focus on pair-wise ties. However, less attention has been given to identification of cohesive subgroups in two-mode affiliation networks. Two mode affiliation networks focus on ties existing among actors through joint affiliations. Therefore, in this paper we evaluate two cohesive subgroups identification methods i.e. edge betweenness and hierarchical clustering, for two-mode affiliation network using the Wikipedia data. We conclude from our results that edge betweenness technique, when applied to two-mode affiliation network, is a better techniques in terms of the modularity value that means it can generate more strong social communities in terms of social ties. On the other hand this technique is less time efficient as compared to hierarchical clustering.

KEYWORDS

Social Networks, Community Identification, Cohesive subgroups, Edge Betweenness, Hierarchical Clustering, Dendrograms.

1. INTRODUCTION

Social networking is an emerging field of research. Social network is a structured representation of the social actors and there interconnections a.k.a. ties [5]. Social networks form social groups or social communities that share interests. These communities on the web are steadily emerging and the demand for forming an on demand social network is immense. Community members profit from being linked to other people sharing common interests, though having widely dispersed residences. Without these online social community portals on the web, people would not be able to find other people sharing the same interest and being available for discussion and collaborations. For example, if a person is searching for specific information, he can look at the interests of people in his social network and get quite relevant references. Therefore in order to fully benefit from social networks, people should be able to identify the community they belong to. In this paper we deal with a topological property of networks, the cohesive subgroups/communities [5][6][13]. The concept of community is common, and it is linked to the classification of objects in categories or subgroups. It is critical to construct efficient procedures and algorithms for the identification of community structure in a generic network. Several types of algorithms exist for analysis and identification of cohesive subgroups in one-mode networks that focus on pair-wise ties [1][2]. However, less attention has been given to identification of cohesive subgroups in two-mode affiliation networks that focus on ties existing among actors through joint affiliations. In this paper we create social network based on the method proposed in [14]. In [14] an edge within a network can represent social interactions, common affiliations, organizational

structure, physical proximity etc. Furthermore, we analyze the usefulness of community formation methods in order to identify cohesive subgroups using edge betweenness and hierarchical clustering methods. We evaluate these methods qualitatively using the definition of community i.e. a community is defined as a subset of nodes within the graph such that connections within a community are denser than the connection with rest of the network. In this paper first of all we give a brief introduction to the Wikipedia data structure. Section 3 deals with the methods of identification of cohesive subgroups. This section is followed by section 4 in which we give a comparison between cohesive subgroups identification techniques. In the end we discuss our results and give some concluding remarks.

2. WIKIPEDIA DATA

In this section we will discuss about the structure of Wikipedia data. We used Wikipedia data for our analysis. The following is the information about the data that we have used for our analysis:

1. Number of articles: 10,218,632
2. Number of users: 65,678
3. Number of revised articles analyzed: 234,357
4. Total number of article revisions studied: 31,135,556
5. Wikipedia dump date: September 08, 2007.

There are 41 Wikipedia tables[12][16]. In this paper we will use only four tables to extract most of our interesting conclusion. The tables that we have used are page table, user table, revision table and categorylink table. Page table is considered to be the core of Wikipedia. It contains the entry of each page in Wikipedia. This table does not contain the page text, it only contain information about the page identity, reference for it in text table (this table contains the page text) and revision table (this table keeps track of the page revision made by users). User table stores the information about the Wikipedians. Wikipedians are authors/editors of the Wikipedia articles. This table contains information about user identity and user privileges. Next is the revision table, this is the most important table for our social network construction methods. This table holds information about all the edits made to the article by Wikipedians. It keeps track of the article to which edit was made, who made this edit and what time it was done. We use this table to find communities of users according to their article edit patterns. This table forms a baseline for our analysis. The last table which we used in our analysis is categorylink table. This table stores the categories to which a page is associated. This table is used to add the third dimension to our data i.e. Category. Every page is associated with some categories and from this table we can extract the information about what categories a page is associated with.

3. IDENTIFICATION OF COHESIVE SUBGROUPS

In this section we will discuss different methods of cohesive subgroup identification when applied to Wikipedia data. First of all we explain the methods we used to form social network from Wikipedia. In the next two sections we will apply two methods of cohesive subgroup identification, i.e. Edge Betweenness and Hierarchical Clustering, to this social network and discuss our results. The method that we will use for cohesive subgroup identification is called LS Set. In this method we compare ties within the subgroup to ties outside the subgroup. More formally we can say that if G_s is a sub social group of a social network G , then authors in the sub social group G_s are given by $Author(G_s) = N_s$. Suppose $L \subset N_s$, therefore L is a strong cohesive subgroup of N_s if L has more social ties (Lines) within N_s than outside of N_s . This can be formally written as following and demonstrated in (Figure 5a):

$$\{L \xleftrightarrow{Lines} N_s - L\} > \{L \xleftrightarrow{Lines} N - N_s\}$$

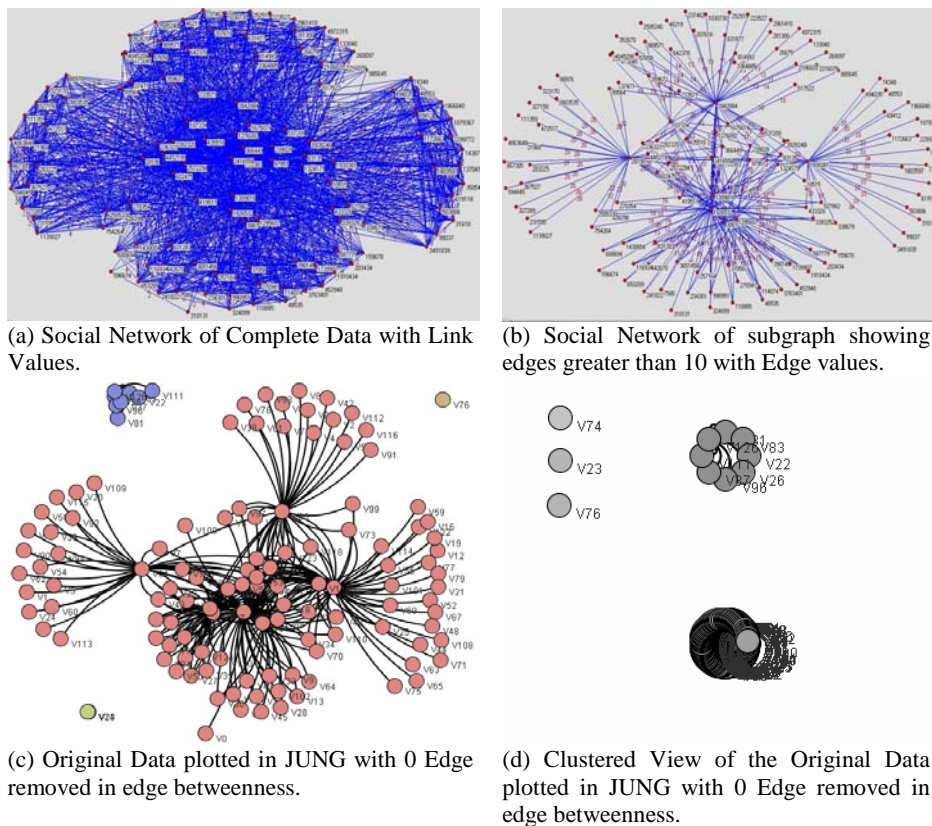


Figure 1. Social Network Formed from Wikipedia Sports Data.

3.1 Social Network Extraction from Wikipedia

The dataset that we used for our social network extraction is: Sports -> Sports by country -> Cricket by country -> Cricket in Australia -> Australian first class cricket teams. There are nine categories in this dataset: List_of_Tasmanian_representative_cricketers, New_South_Wales_Blues, Prime_Minister's_XI, Queensland_Bulls, Southern_Redbacks, Tasmanian_Tigers, Victorian_Bushrangers, Western_Fury and Western_Warriors. We created this social network based on our tripartite model presented in the paper [14]. In addition to that we also used Principle Component Analysis (PCA) technique to find out similarities and associations between the users. In order to extract the related actors to a category we run an SQL query on our Wikipedia database. In this query we select rev_user, rev_user_text, count(rev_page) from the revision table where rev_page= <<page_id>> and rev_user <> 0 and then we group the data by rev_user. After this extraction we plot the data. These self explanatory graphs are plotted using Pajek[9][11] (Figure 1(a)-1(b)) and JUNG[10] (Figure 1(c)-1(d)).

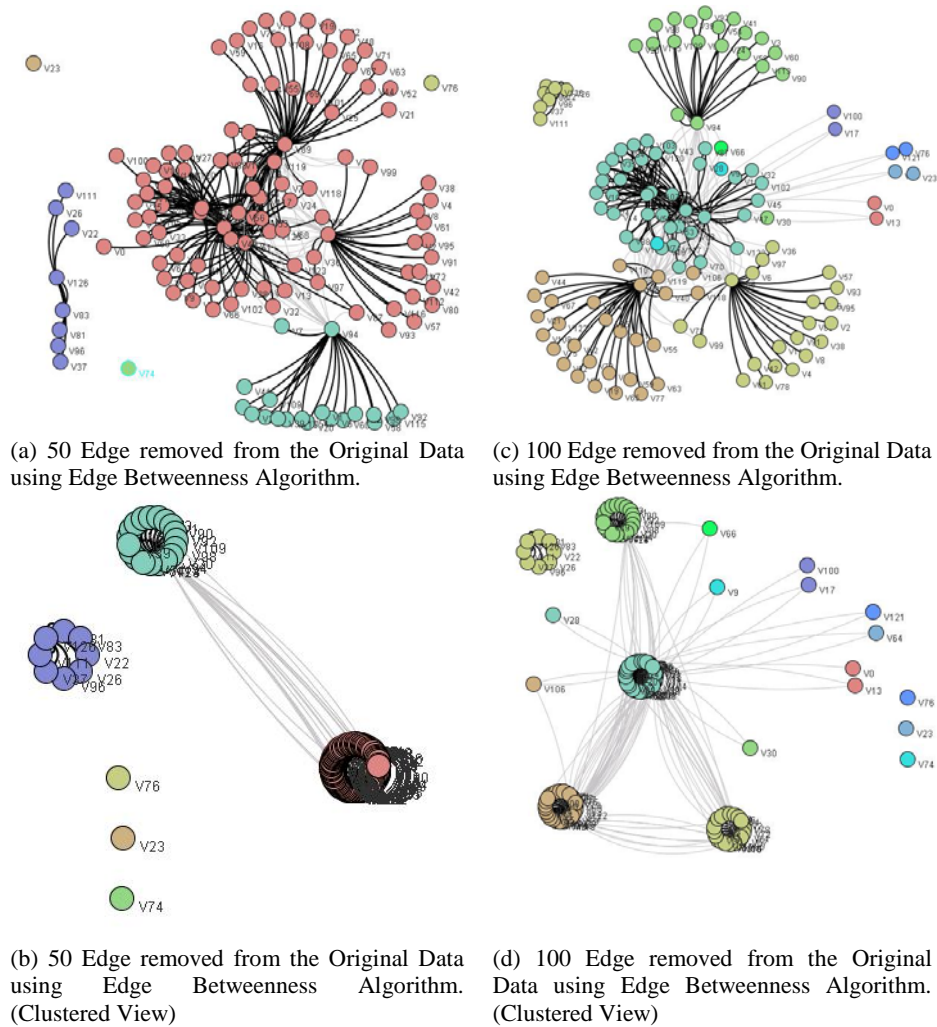


Figure 2. Cohesive Subgroup Formation Using Edge Betweenness Algorithm on Wikipedia Data.

3.2 Cohesive Subgroup Identification Using Edge Betweenness

In a dense social network [4] if any two edge nodes have to reach each other they will have to pass through one or more nodes in between the network. Then the edge in the middle that has the most influence of the reach-ability property of the nodes on the edge has the highest betweenness. In this method we remove such edges to form cohesive subgroups from a social network. Consider for example if actor A1 has to reach actor A2, so the shortest path between the two actors is: $A_1 \leftrightarrow A_2 = \{A_1, A_5, A_6, A_7, A_2\}$. In another example, actor A10 has to reach actor A11, then the shortest path is: $A_{10} \leftrightarrow A_{11} = \{A_{10}, A_6, A_7, A_{11}\}$. In this example the highest edge betweenness is of the edge $A_6 \leftrightarrow A_7$. Therefore if we remove one edge with the highest betweenness we will get two cohesive subgroups considering A1, A10, A5 and A11, A2 are well connected. Then the two subgroups will be: $G_1 = \{A_1, A_5, A_6, A_{11}\}$ and $G_2 = \{A_2, A_7, A_{11}\}$. Now we apply this on our extracted social network from Wikipedia with edges greater than 10 shown in Figure 1(b,c,d). The results of this edge betweenness are shown in the Figure 2.

3.3 Cohesive Subgroup Identification using Hierarchical Clustering

Hierarchical clustering is a data analysis technique that is ideally suited for partitioning actors in cohesive subgroups [17]. Hierarchical clustering groups entities into subsets (communities) that are structurally equivalent. Two vertices in a graph are said to be structurally equivalent if they have identical ties to and from all other actors in the network [3][13]. In this paper we have extended the definition of structural equivalence in order to represent our tripartite social network model [14]. In our paper we denote the structural equivalence of two actors A_1 and A_2 using $A_1 \xleftrightarrow{E} A_2$. Two actors are structurally equivalent if they have both edited the same articles or that have edited the articles belonging to the same categories. More formally we can define as:

$$[A_1 \rightarrow \{I_1, I_2, I_3\}] \xleftrightarrow{E} [A_2 \rightarrow \{I_1, I_2, I_3\} \text{ or } A_2 \rightarrow C_1]$$

Where $I_1, I_2, I_3 \subseteq C_1$

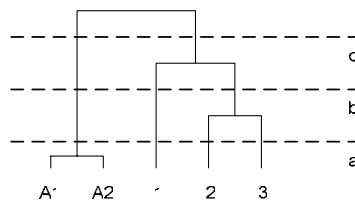


Figure 3. Example Dendrogram of a social Network

Now we will apply our approach to calculate structural equivalence to social network in Figure 1. We have taken a subset of two actors and four instances, therefore total possible connections will be $2 \times 4 = 8$. If we have only have one instance i.e. I_4 included in both of the actors. Therefore the equivalence value for these actors will be: 0.125. Now we check the structural equivalence using the categories. We have nine categories and two actors so that possible relations are: $9 \times 2 = 18$. Therefore the equivalence value for these actors will be: 0.278. Once we have calculated the equivalence value for all the possible pair of actors then we create a density metrics to draw a dendrogram. Then using the dendrogram we create communities as show in Figure 4.

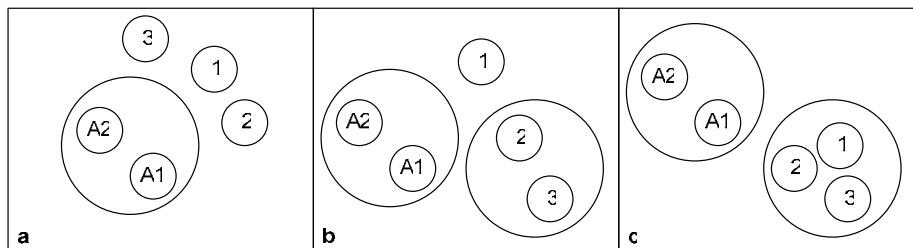


Figure 4. Community Formation from Dendrogram (a) First Level of Dendrogram, (b) Second Level of Dendrogram, (c) Third Level of Dendrogram

4. COMPARISON OF COHESIVE SUBGROUP IDENTIFICATION TECHNIQUES

We compare the two cohesive subgroup identification techniques using the concept of modularity [8]. The basic idea is to compare ties within the subgroups to ties outside the subgroup by focusing on the greater frequency of ties among subgroups members compared to the ties from subgroups members to outsiders (Figure 5).

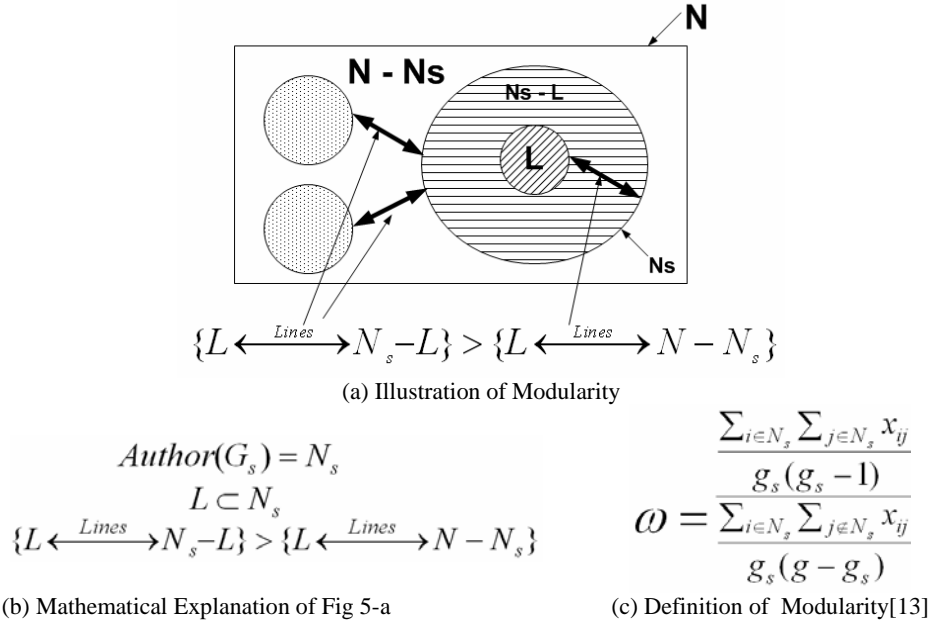


Figure 5. Explanation of the Modularity Concept

In edge betweenness [15] we find out the highest value of Q [8] after removing an edge with the highest betweenness. In the case of hierarchical clustering we find out the highest value of Q at each step of clustering as shown in Figure -3 i.e. Step a,b and c. The formal definition of Q is given in Figure 5(c). Here we can observe the following:

$$Q = \begin{cases} 1 & \text{No_Diff} \\ >1 & \text{Strong_Within_Group} \\ <1 & \text{Strong_Outside_Group} \end{cases}$$

In Figure 5(c) we denote modularity using Q . We can see that if the value of Q is 1, this means that there was no difference after or before applying the clustering algorithm. If the value is greater than 1 this means that the cohesive subgroups are strong and if it's less than 1 then the cohesive subgroups are weak. Strong cohesive subgroups mean that ties of vertices within a group are stronger than with the vertices outside the group and weak subgroup is the opposite.

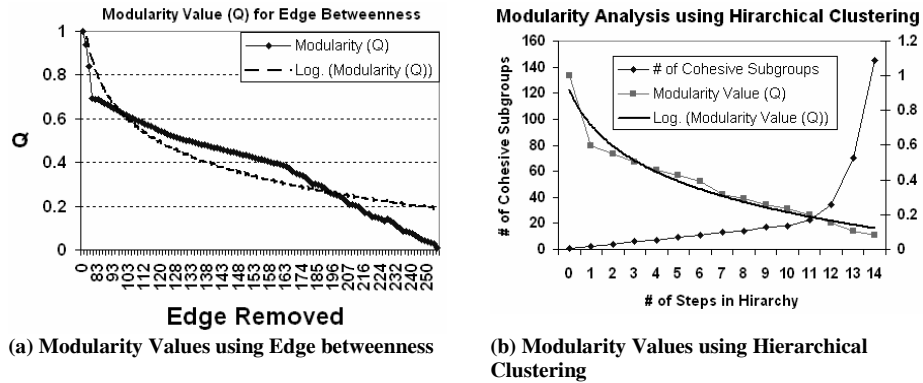


Figure 6. Comparison between Edge betweenness & Hierarchical Clustering

In Figure 6(a) and 10(b) we can clearly see that the value of Q is much higher in the case of edge betweenness as compared to hierarchical clustering. On the other hand the time taken in determining cohesive subgroups by edge betweenness is much higher than the time taken by hierarchical clustering. In

hierarchical clustering the major time is utilized in finding the structural equivalence of all pairs of actors. Another interesting thing to note in both of these techniques is that number of cohesive subgroups rise nearly exponentially if we increase the edge removal. This creates a relationship between number of cohesive groups and modularity value. They both are directly proportional to each other, as they both rise and fall together. This is apparent in Figure 6(b).

5. CONCLUSION

Identification of cohesive subgroups is an important research area in social network analysis. Currently in the literature several types of algorithms exist for analysis and identification of cohesive subgroups in one-mode networks. In this paper we have studied identification of cohesive subgroups in two-mode affiliation networks that was not the major focus of previous research. Therefore in this paper we analyzed two techniques for the formation of cohesive subgroups i.e. edge betweenness and hierarchical clustering. We can conclude from our results that edge betweenness is a better techniques in terms of the modularity value that means it can generate more strong social communities. On the other hand this technique is not efficient with time, time efficiency of hierarchical clustering technique is better. We also observed a general conclusion that number of cohesive subgroups rise nearly exponentially if we increase the edge removal or come down from the root level to leaf nodes in hierarchical clustering. This creates a relationship between number of cohesive subgroups and modularity value. They both are directly proportional to each other, as they both rise and fall together. As our future work we will expand our study to different types of social network and see if our findings are applicable to a wide range of social networks as well.

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